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TRANSCRIPT OF CONFERENCE ON INTERSTATE POLLUTION OF THE ANIMAS RIVER, COLORADO-NEW MEXICO HELD AT SANTA FE, NEW MEXICO ON APRIL 29, 1958

PUBLIC HEALTH SERVICE, WASHINGTON, D. C.

APRIL 1958

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TRANSCRIPT OF CONFERENCE

ON

INTERSTATE POLLUTION

OF THE

ANIMAS RIVER

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COLORADO - NEW MEXICO

SANTA FE, NEW MEXICO

APRIL 29, 1958

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16. Abstracts

Representatives of the Public Health Service, the New Mexico and Colorado Departments of Public Health, Atomic Energy Commission, Colorado Game and Fish Department, Vanadium Corp. of America, and Animas River water users presented statements at this conference on interstate pollution. The discussion was guided by the provisions of the Federal Water Pollution Control Act, in which a conference may be called by one state that is being affected by pollution originating in another state. Pollution monitoring data are reviewed, problems described, and possible solutions examined.

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TABLE OF CONTENTS

Conferees ----------Page 1

Statements Presented:

Opening statement, Mr. Murray Stein, PHS----------Page 4

Public Health Service, Mr. Keith S. Krause ---------Page 6
Dr. E. C. Tsivoglou ---------Page 9

N.M. Dept. Public Health, Mr. Charles Caldwell -----Page 20

Colo. Dept. Public Health, Dr. R. L. Cleere --------Page 23

AEC, discussions by Dr. D.I. Walker,
Mr. Robert Barker, Mr. Frank McGinley ---------Page 26

Colo. Game & Fish Dept, Mr. Richard Moore ----------Page 33

Vanadium Corp. of America, John A. Maxwell ---------Page 35

Animas River Water Users, Mr. W. L. Bruce ----------Page 41

Afternoon Session ----------Page 48

Summary, Mr. Murray Stein ----------Page 54

Attendance Roster ----------Appendix A

CONFERENCE AT SANTA FE, NEW MEXICO
On Interstate Pollution
Of the Animas River, Colorado-New Mexico

Mabry Hall
Santa Fe, New Mexico
April 29, 1958

Chairman: Mr. Murray Stein
Chief of the Enforcement Section
Water Pollution Control Program
U. S. Public Health Service
Washington 25, D. C.

Conferees: Mr. Keith S. Krause
Assistant Regional Engineer
Public Health Service - Region VII
Dallas, Texas

Stanley J. Leland, M. D., Director
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Charles G. Caldwell, Director
Environmental Sanitation Services
New Mexico Department of Public Health
Santa Fe, New Mexico

Roy L. Cleere, M. D., Executive Director
Colorado Department of Public Health
Denver, Colorado

Mr. William N. Gahr, Director
Division of Sanitation
Colorado Department of Public Health
Denver, Colorado

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OTHER APPEARANCES

U. S. Public Health Service:

Dr. E. C. Tsivoglou
Chief of Technical Water Pollution Research
Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

Mr. Robert Morfitt, Sanitary Engineer
Indian Health Facilities, Public Health Service
Window Rock, Arizona

Atomic Energy Commission:

Mr. F. E. McGinley
Grand Junction Operations Office
Grand Junction, Colorado

Dr. Don I. Walker
Idaho Operations Office
Idaho Falls, Idaho

Mr. Robert F. Barker
Division of Licensing and Regulation
Atomic Energy Commission
Washington, D. C.

Vanadium Corporation of America:

Mr. John A. Maxwell
Vanadium Corporation of America
Durango, Colorado

Mr. Fred A. Brinker
Vanadium Corporation of America
Durango, Colorado

State of Colorado:

Mr. Richard L. Moore
Colorado State Game and Fish Department
Denver, Colorado

Mr. W. L. Bruce, Secretary-Treasurer
Animas River Water Users Association
Durango, Colorado

Mr. J. D. Torrey, Industrial Hygienist
Colorado Department of Public Health
Denver, Colorado

John B. Barnard, Jr.
Assistant Attorney General
Denver, Colorado

State of New Mexico:

Warren A. Rasmussen, M. D.
District Health Officer
San Juan County Health Department
Aztec, New Mexico

State of New Mexico: (continued)

Mr. Robert P. Lowe, Assistant Director
Environmental Sanitation Services
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Carl R. Jensen, Assistant Director
Environmental Sanitation Services
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Steve E. Reynolds
State Engineer
Santa Fe, New Mexico

(A list of others in attendance is attached as "Appendix A")

MR. STEIN: May we get started? The Conference is open.

This conference in the matter of pollution of the interstate waters of the Animas River involving the States of Colorado and New Mexico, is being held under the provisions of the Federal Water Pollution Control Act. Under the terms of that Act the Surgeon General of the Public Health Service is required to call a conference of this type when requested to do so by a State water pollution control agency. Upon receipt of a request from Doctor Leland, State Health Officer of New Mexico, this conference has been called by the Surgeon General. The purpose of the conference is to bring together State and local water pollution control agencies and the Public Health Service, and other interested parties to review the existing situation, the progress which has been made and to lay a basis for future action by all parties concerned, and to give the States, localities and industries an opportunity to take any remedial action which may be indicated under State and local law.

The conference technique is a rather old one. As a matter of fact it is used by many State agencies informally in the normal conduct of their business in the field of water pollution control. The notion of a conference was proposed by United States Supreme Court in the famous case of New York and New Jersey involving interstate pollution. The court said as far back as 1921 "We cannot withhold the suggestion, inspired by the consideration of this case, that the grave problem of sewage disposal presented by the large and growing populations living on the shores of New York Bay is one more likely to be wisely solved by cooperative study and by conference and mutual concession on the part of representatives of the states so vitally interested in it than by proceedings in any court however constituted."

This we think is particularly applicable to the relatively complex situation such as we have in the Animas River. Under Section 8 of the Federal Act the Surgeon General has notified the official State water pollution control agencies of this conference. These agencies are the Colorado State Department of Public Health, and the New Mexico Department of Public Health. Under the law this is a conference between these official agencies and the Public Health Service. The official agencies of course are privileged to bring whomever they wish to the conference and have them participate in the conference. The conferees have been designated by these agencies: for New Mexico the conferees are Doctor Stanley Leland, Director of Public Health of that State, and Mr. Charles G. Caldwell, State Sanitary Engineer; for Colorado, Doctor Roy L. Cleere, Executive Director of that Health Department, and Mr. William N. Gahr, State Sanitary Engineer; for Public Health Service, Mr. Keith S. Krause, Assistant Regional Engineer, Region VII; and my name is Murray Stein, I am from headquarters, Public Health Service.

Both the States and Federal Government have responsibilities in dealing with interstate water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control interstate pollution. It has always been the policy of the Public Health Service to recognize this traditional role of the States. The function of the Public Health Service is to encourage the States in this activity. However, the Public Health Service is charged by law with specific responsibility in connection with interstate pollution control problems.

The Federal Water Pollution Control Act provides that pollution of interstate waters which endangers the health or welfare of persons in a State other than that in which the pollution originates is subject to abatement. The conference will be useful in providing a clear record delineating the progress which has already been accomplished and indicating what still needs to be done in correcting the interstate pollution problem. Under the Federal Law the Surgeon General is required at the conclusion of the conference to prepare a summary of the conference which will be sent to all conferees. The summary, according to law, must include the following:

(1) Occurrence of pollution of interstate waters subject to abatement under the Federal Act;

(2) Adequacy of measures taken toward abatement of pollution; and

(3) Nature of delays, if any, being encountered in the abatement of pollution.

Where the situation does not lend itself to the covering of all these points at one session of the conference, we have held conferences in two sessions; the second session to be held on the call of the chairman after a reasonable opportunity has been given to develop additional information. If this situation should be one of this type it is suggested that consideration might be given to designating the proceedings today as the first session of the conference and scheduling a second session in the future.

Now, a word about the procedures governing the conduct of the conference -- Mrs. Price is making a stenographic report of these proceedings for the purpose of aiding us in preparing a summary and also providing a record of what is said and done here. We will make copies of the summary and transcript available to the conferees.

An agenda has been provided for the conferees. The agenda is to aid us in directing our discussion toward the points required to be covered by law. However, the agenda can be adjusted to meet particular situations as they arise.

All the conferees will be called upon to make statements. The conferees, in addition, may call upon the participants they have invited to the conference to make statements. At the conclusion of such statements the conferees will be given an opportunity to comment or question, and at the conclusion of the conferees' comments or questions, I may ask a question or so, too.

This procedure has proved effective in developing a clear statement of the problem and reaching agreements on equitable solutions.

Now, for the first presentation, I would like to call upon Mr. Keith Krause, of the Dallas Office of the Public Health Service. Before you begin, I should like to indicate that we are having a transcription of the conference made, which will be made available to the States. To aid in making the transcript we are also having a tape recording made, and we have one microphone. Now I would suggest that participants come up in front to these chairs at the table; if we have some difficulty in getting the tape recording we will adjust the mike so you can be heard.

MR. KRAUSE: Thank you, Mr. Chairman. I should like to present the general statement, to be followed immediately by a more detailed statement by Doctor Tsivoglou, Chief of Technical Water Pollution Research, Robert A. Taft Sanitary Engineering Center, Cincinnati. I would like to describe the area under consideration.

A. Physical Description

1. The Animas River rises in southwestern Colorado above Silverton. It flows southerly for approximately 100 miles to its junction with the San Juan River at Farmington, New Mexico. It crosses the Colorado-New Mexico State line near Riverside, New Mexico, a point approximately 30 miles from its mouth. The Florida River is the only main tributary of the Animas and it lies wholly within the State of Colorado.

2. The river basin has an over-all length of approximately 100 miles, 70 of which are in Colorado and 30 miles in New Mexico. The basin is approximately 20 miles wide at its widest portion. The upper part of the basin from Durango, northward is rugged, mountainous country. Below Durango the land is rolling and there is flat land along the stream which is irrigated.

3. Annual rainfall in the basin varies from approximately 15" a year in the southern portion to about twice this amount in the northern mountainous part of the basin. Stream flow gaging stations are located at Durango, Colorado, Cedar Hill, New Mexico, and Farmington, New Mexico. The average daily flows at these three stations are 890, 943, and 1,000 c.f.s. respectively. Minimum daily flows at these stations have been recorded at 94, 90, and 5.4 c.f.s. respectively.

4. The principal towns in the basin and their 1950 populations include the following:

Silverton, Colorado	1,375
Durango, Colorado	7,459
Cedar Hill, New Mexico	200
Aztec, New Mexico	885
Farmington, New Mexico	3,637

Since 1950 the population has increased greatly in the basin. There are now approximately 22,000 people at Farmington, 6,000 at Aztec, and 11,500 at Durango, Colorado. Oil and gas developments in New Mexico have been largely responsible for the large increase of population in Aztec. Uranium mining to the west of the Animas River Basin has brought people to Durango, Colorado. Further industrial expansion is imminent and much of it will be dependent on an ample supply of safe, good quality water.

5. Principal occupations include: farming, oil and gas production and associated service industries, mining, ore processing and miscellaneous occupations.

Numerous mines (lead, silver and gold) are located in the upper portion of the basin between Durango and Silverton, Colorado. Uranium ore is brought into Durango for processing. Industrial activity in New Mexico includes extensive oil field developments in an area extending northwest and southeast of Aztec,

New Mexico. Milling and ore processing is carried on at several mills in the Silverton area.

Agricultural activities include the irrigated farming of river valley lands from Durango southward.

B. Water Uses

Surface water supplies serve the towns of Silverton and Durango, Colorado. Silverton draws water from Mineral Creek to serve 1,375 inhabitants. Durango draws water from the Florida River to serve its population of 11,500. In New Mexico, Aztec draws water from the Animas River to serve a population of approximately 6,000. Farmington also draws water from the Animas River to serve a population of 22,000. Both of these latter towns divert water from the river through channels and Farmington has recently provided facilities to draw supplemental water from the San Juan River during critical times.

C. Plans for Development of Increased Water Uses by the Bureau of Reclamation.

The Bureau of Reclamation has planned several projects in the San Juan River Basin area. The operation of the Hammond and Navajo Projects will at certain times stop the flow of water in the San Juan River between the Hammond Project and the mouth of the Animas River (Farmington) except for irrigation return flow water. A project (Animas-LaPlata Diversion) is currently being studied in the Animas River Basin which would divert flow from the Animas River above Durango for irrigation uses. Water is of utmost importance to the health, welfare and economy of this area.

D. Description of Problem

1. Sources of Pollution: Durango, Colorado is the most significant source of organic pollution of an interstate nature. Remedial measures are planned by Durango as indicated by recently submitted plans for a new secondary sewage treatment plant to cost an estimated $645,640. The city has applied for a Federal construction grant for this facility. Aztec, New Mexico has let a contract for construction of a new secondary sewage treatment plant to cost $253,059.40. Under the provisions of Public Law 660, 84th Congress, a Public Health Service grant of $63,429 was approved in March 1957. One of five ore processing industries located in the Silverton area is in operation and discharges final wastes to the Animas River after treatment in tailings ponds. A meat packing plant and a uranium processing plant are located at Durango.

2. Nature of Pollution: Organic pollution from the town of Durango, Colorado is expected to be rectified when new treatment facilities are built for municipal wastes. Radioactive wastes from the Vanadium Corporation of America plant at Durango are discharged to the Animas River, and there is reason to believe that downstream water uses such as public water supply and crop irrigation may be adversely affected by these wastes.

Dr. Berwyn F. Mattison, Member, National Advisory Committee on Radiation, has aptly expressed the problem of radiological hazards in relation to public health in an article appearing in the American Journal of Public Health, January 1958. Doctor Mattison states, "Is radiation a major public health problem? We have seen that a number of health agencies believe that it is. But what criteria must we apply to make this determination? First, the extent of the problem merits public

consideration. There is not one among us who will not, throughout his lifetime, be affected by cosmic radiation, and most of us at some time will be affected by one or more of the following - radiation received in a physician's office or a dentist's office, radiation received while working in certain industries, radiation received through ingestion of foods and, of course, the new hazard, its extent not yet clear, radiation from fallout produced by testing of nuclear weapons.

"Second, is this a problem which can be handled adequately by each individual? Obviously it is not, and some concerted community-wide action will be required if radiation hazards are to be adequately controlled.

"Third, are the hazardous conditions produced through radiation correctible to any significant degree? Here our knowledge is much more recent, but it certainly has been well established by the Atomic Energy Commission that a great deal of work with massive sources of radiation can be done safely, providing meticulous care is exercised in utilizing protective devices. Furthermore, our brief experience in Pennsylvania has shown that inspection of sources of radiation in daily use across the Commonwealth can repeatedly uncover needless (and frequently unrecognized) sources of stray radiation which are correctible on a practical and economical basis.

"Using these three criteria, alone, I believe that the place of radiologic health as a major public health problem has been demonstrated."

3. Available Information on Stream and Wastes:

Table 1

WATER QUALITY CHARACTERISTICS* - 1955 1/
Radioactivity uuc/l

Sampling Point	Gross Alpha Susp.	Gross Alpha Diss.	Gross Alpha Total	Gross Beta Susp.	Gross Beta Diss.	Gross Beta Total	Soluble Radium
	in uuc/l						
Durango, Colo.							
Direct effluent	33,200	10,000	43,200	2,300	14,000	16,300	76
Tailings Pond effluent	300	2,900	3,200	2,300	5,200	7,500	25
Animas River							
Above Durango	2	0	2	4	28	32	0.2
Below Durango	7	27	34	22	4	26	3.3

*Grab samples

Average Natural Background Radioactivity

Gross Alpha (Dissolved)	10 uuc/l
Gross Beta (Dissolved)	24 uuc/l
Soluble Radium	0.3 uuc/l

1/ Report of a "Survey of Contamination of Surface Waters by Uranium Recovery Plants", Sept. 1955, Tsivoglou, Bartsch, Rushing, Holaday.

Table 2

RADIUM CONTENT OF ANIMAS RIVER NEAR DURANGO, COLO.
(Colorado-New Mexico) 2/

Location	Soluble Radium		
	Water, uuc/l	Stream biota, uuc/gm	
		Plant	Animal
1950			
Above Durango	0.20	-	-
Below Durango	4.5	-	-
1955			
Above Durango	0.20	6	6
Below Durango	3.3	660	360

2/ (Ibid)

Organic and bacterial pollution control should not present serious problems. The full extent of the radiation exposure to users of Animas River water still must be evaluated. Very limited studies conducted by the Public Health Service in 1955 indicated that the gross Alpha concentration below Durango was 34 uuc/l in the water; 850 uuc/gram in the river mud, and 2600 uuc/gram ashed weight, in plant life of the stream. Corresponding increases occurred for gross Beta activity. Radium was concentrated by a factor of 100 in the stream biota. If food crops irrigated by Animas River water would show a similar increase, this would constitute a serious problem.

In summary, the degree of exposure and the scope of the problem should be delineated at the earliest possible time. Sufficient data for this purpose is not now available. A survey to secure the needed information should be started immediately. If the indications of excessive discharges of radioactive wastes are confirmed, specific corrective action should be initiated at once.

MR. STEIN: Thank you, Mr. Krause. Doctor Tsivoglou, would you continue the statement?

DOCTOR TSIVOGLOU: Introduction and Background. On the basis of the limited information now available, radioactive waste discharges from the uranium refinery at Durango, Colorado, appear to present a significant problem in terms of legitimate and desirable downstream uses of the Animas River. Analysis of this problem is complicated, however, by other radioactive contamination of the local environment, and by the variety of ways in which the radioactive substances involved can be ingested. As a result, a survey to evaluate total internal radiation exposure in the Durango-Farmington area is needed before appropriate remedial measures for waste disposal by the uranium mill can be determined. However, as these studies progress, interim remedial measures will probably suggest themselves, and can be effected at once.

In most areas of the country, and in this area in particular, there is not sufficient water available for all desirable uses. It is therefore necessary to use the available water as efficiently as possible, and to expect it to be used and re-used for various purposes. Such uses include, for example, domestic water supply, irrigation, recreation, stock watering, industrial process

water supply, and waste disposal. The Animas River below Durango is used for at least four of these purposes. It is the source of domestic water supply for Aztec and Farmington, New Mexico, or some 28,000 people, and a portion if its flow is diverted between Durango and Farmington to irrigate some 26,000 acres of agricultural land; its recreational use includes fishing, and it serves for stock watering and waste disposal.

It is important to distinguish between "natural" or "background" radioactivity, and that which is added artificially as pollution. Natural waters have always contained a small amount of radioactivity, entirely derived from radioelements such as uranium, thorium, radium, and potassium-40 that occur naturally in the earth's crust. (1) Although there are few exceptions such as hot springs, this natural radioactivity of surface and ground waters is generally considerably less than the permissible amount.(2) The background radioactivity of the Animas River is low - for example, its dissolved radium content is no more than 10 percent of the permissible amount (see Table I). Since the advent of nuclear weapons testing there has been a general increase in the radioactivity of the environment. Nuclear industry such as uranium refineries or atomic power plants may further add to local environmental radioactivity by discharging radioactive wastes.

Radioactive materials that are ingested or inhaled result in internal radiation exposure, as contrasted to the external exposure that results from a source of penetrating radiation located outside the body. On ingestion, certain radioelements tend to accumulate in specific body organs - for example, radium and strontium accumulate in the bones, while iodine goes to the thyroid gland. Such radioactive materials irradiate the surrounding tissue until they have decayed or have been biologically eliminated. As regards radioactive wastes from the Durango uranium mill, we are concerned with internal radiation exposure of the local population, and the remainder of this statement considers only internal exposure.

In determining criteria for the safe disposal of radioactive wastes it is also important to consider <u>all</u> means by which the local population group is exposed to radiation. The effects of radiation exposure are cumulative, and the total exposure of a population is much more significant than the fraction of it associated with one particular source such as drinking water. An individual or a community may drink slightly contaminated water and milk, eat slightly contaminated food, and breathe slightly contaminated air. A portion of the individuals may during their working hours inhale or ingest somewhat higher amounts of radioactive materials as a result of their occupation in the nuclear industry. It is the <u>total</u> exposure that has real significance, and it is important to examine each source, such as a domestic water supply, in the light of the total radioactivity intake from all local sources. While any <u>individual</u> exposure, such as that from the domestic water supply, may be lower than the maximum allowable, the total radiation exposure from all sources may exceed that regarded as safe.(2)

In the Durango-Farmington area there are several sources of internal radiation exposure. Data that will be presented later indicate a certain amount of dissolved radium and other radioelements in the Animas River below the Durango uranium refinery. Green plants will concentrate and accumulate radium to some unknown extent from irrigation water that contains radium. Animals, domestic and game, that drink from the river and graze on irrigated lands may also accumulate some radium. The river fish may contain small quantities of these wasted

radioelements. Radioactive suspended solids, if discharged into the river, may to some degree contaminate water treatment equipment such as filters in downstream water treatment plants. It may well be that, taken individually, any of these paths of human radiation exposure is small. Nevertheless, they are additive, and their total effect may be significant.

In addition to the above sources of exposure, one must consider the human intake of radioactive materials that are distributed by virtue of nuclear weapons tests. The resulting fission products are distributed into the air, soil, water and all phases of the environment. The regional distribution of these materials is dependent upon frequency of weapons tests, location of the test site, local and general meteorological conditions, and other factors. Although many radioelements are so distributed, our concern here is mainly with radioactive strontium, because its behavior and effect is similar to that of radium. Thus, in terms of exposure of the population of the Durango-Farmington area, some radioactive contamination of water, fish, soils, crops, milk, etc., has resulted from the worldwide testing of nuclear weapons. The resulting radiation exposure must be added in some cases to that which comes about from the local uranium refinery.

I do <u>not</u> intend to imply by all this that the people of the Durango-Farmington area are being exposed to dangerous amounts of radioactivity. I have attempted to list the possible sources of exposure, and to indicate that we do not have adequate knowledge as to the actual exposure contributed from each source. The degree of total radiation exposure cannot be known until considerably more data are obtained.

<u>Past Studies and Available Data</u>

The first brief investigation of stream contamination by uranium refineries was performed in October 1950 by the Public Health Service at the request of the interested States.[3] Samples of river water were collected at locations above and below each of four operating mills, of which the Durango mill was one. The samples were analyzed for radium, as this was considered the most significant radioactive waste product. The analytical results are shown in Table I. This survey was a brief reconnaissance intended only to roughly determine existing radium concentrations in the Animas River.

In the fall of 1955 a second brief survey was performed on streams in the vicinity of eight operating mills.[5] The Durango mill was included. At this time samples of river water, bottom mud, and biota (algae, insects) were collected at locations immediately above and below the mill and analyzed for gross radioactivity and for radium. Samples of the effluents from the mill were also collected and analyzed at this time. Results are given in Table I for the water samples and effluents, and in Table II for the mud and biological samples.

The effluents from the mill were at quite small flow rates at the time of the 1955 survey, hence, although their radioactivity was high relative to the natural stream radioactivity, the dilution effect was great, as indicated by the results obtained at the downstream sampling point. Both sampling runs indicated a gain in the dissolved radium content of the river by a factor of about 20.

The biological and mud samples are cumulative as contrasted with the instantaneous samples of flowing river water. Thus, they yield something more

than a momentary indication of stream radioactivity. Rather they represent some unknown period of accumulation of radioactive material discharged from the mill. These data indicate a gain by a factor of about 100 in the radium content of the stream biota. Radium was not determined at this time for the mud samples.

Table I

Radioactivity of Water Samples
(Animas River near Durango, Colorado)

Location	Radioactivity, uuc/l.						
	Gross Alpha			Gross Beta			
	Susp.	Diss	Total	Susp.	Diss.	Total	Dissolved Radium
1950							
Animas River Above Mill	--	--	--	--	--	--	0.20
Animas River Below Mill	--	--	--	--	--	--	4.5
1955							
Animas River Above Mill	2	0	2	4	28	32	0.2
Animas River Below Mill	7	27	34	22	4	26	3.3
Direct Effluent from Mill	33,200	10,000	43,200	2,300	14,000	16,300	76
Tailings Pond Effluent from Mill	300	2,900	3,200	2,300	5,200	7,500	25

Table II

Radioactivity of Mud and Biological Samples, 1955
(Animas River near Durango, Colorado)

Location	Radioactivity, uuc/gm.							
	Mud		Algae			Bottom Insects		
	Gross Alpha	Gross Beta	Gross Alpha	Gross Beta	Radium	Gross Alpha	Gross Beta	Radium
Animas River Above Mill	16	71	85	200	6	100	260	6
Animas River Below Mill	850	550	2,600	8,600	660	1,500	4,800	360

Flows in the Animas River at Durango were 250 cfs in 1955 and 220 cfs in 1950 at the time of sampling. These data indicate an approximate discharge of 2.0 milligrams per day of dissolved radium from the Durango refinery.

I would like to emphasize that the data contained in Tables I and II are not considered representative of any long period of time. They represent only isolated samples, and cannot be considered, for example, as average results for any significant period of time. The annual or monthly average radioactivity discharges from the Durango uranium refinery may be either somewhat higher or lower than these data, and we have no knowledge of this at this time. The data do indicate a definite gain in stream radioactivity below the mill. The significance of this gain is in doubt because of the very few analytical survey results that are available now. We are concerned with radiation exposure representative of a substantial period of time, rather than with a few not necessarily representative isolated samples.

No data are available that specifically regard the radiation exposure of people of the Durango-Farmington area as the result of fallout from nuclear weapons tests. As has been indicated, this is a part of the total radiation exposure picture, and must be added to the exposure from the local source of pollution. Radiostrontium contamination of this area may be relatively low or high - as no data are available for this area, no conclusion can be reached on this point, except that information is needed.

The limited available data indicate that existing levels of radium alone in the Animas River may be at or near recommended safe concentrations for public water supplies. However, allowance must also be made for other paths of radium intake and for the presence of other hazar dous radioelements. It is therefore not possible at this time to evaluate the full public health significance of radioactive waste discharges to the Animas River. Considerably more specific data must be obtained before adequate and proper waste control measures at the Durango mill can be recommended.

Existing Standards

Maximum Permissible Concentrations (MPC's) in air and in domestic water supply for most radioelements are listed in Handbook 52, National Bureau of Standards,(2) and these are the basic recommendations for protection against excessive internal radiation exposure. An addendum (4) to Handbook 59, National Bureau of Standards indicates that the concentrations listed in Handbook 52 represent allowable internal exposure for radiation workers, and should have a safety factor of ten applied for protection of the general population outside the controlled area, or industrial site. These MPC's refer to the amount of any listed radioisotope that can be ingested in domestic water supply continuously over a lifetime without producing any readily detectable biological damage.

Radium is a long-lived alpha emitter that deposits in the bones. It decays successively to several other elements, or daughters, that are also radioactive. The MPC for radium plus one-half of the equilibrium amounts of its radioactive daughters in public water supply is 4 micromicrocuries per liter (uuc/l). In terms of radium alone, that is without any of its radioactive daughters, the figure is in the neighborhood of 2 uuc/l. This is the lowest of all of the MPC's listed in Handbook 52 for domestic water supply, and in these terms radium is considered the most hazardous of all of the listed radioisotopes.

Strontium-90 also decays to a radioactive daughter, yttrium-90, and the MPC for strontium-90 plus an equilibrium amount of yttrium-90 in domestic water supply is 80 uuc/l. Strontium is also relatively long-lived, emits betaparticles during decay, and deposits primarily in the bones. It has next to the lowest of all of the Handbook 52 MPC's in domestic water supply, being second only to radium in this regard.

The basic principle of protection against internal radiation exposure is to place an upper limit on the amount of exposure that can be allowed for the affected organ. This has the effect of placing an upper limit on the total allowable intake of any particular radioisotope. Thus, if radium were the only radioisotope involved here, and if the domestic water supply were the only means of human intake, then the domestic water supply could allowably contain as much radium as is specified by its MPC. If, however, radium is ingested via several paths such as domestic water supply and crops that have radium in them, then the total intake of radium must be considered. Thus, if the crops contained a relatively large quantity of radium, the content of the water supply would have to be severely limited, at some level well below the MPC. Conversely, if the domestic water supply were to contain the maximum permissible amount of radium, then intake via other paths such as food would result in exceeding the safe radiation exposure.

The same principles apply to combinations of radioisotopes that affect the same organ. To quote Handbook 52: "Often a person is subject to radiation exposure from several different sources simultaneously. In any case, the maximum permissible concentration of radioisotopes in air and water and the external radiation should not exceed values that will permit an exposure of 0.3 rem/week to any part of the body except the epidermal skin layer." Thus, because radium and strontium both affect the bones, they must be considered together as a source of internal radiation exposure, and the allowable intake of one is directly affected by the presence of the other. For example, if a domestic water supply were to contain the maximum permissible amount of strontium-90 then no radium could be permitted in it, and vice versa; or, if the water supply contained half of the MPC of strontium-90, then only half of the radium MPC could be allowed. The intake of either of these radioelements by other paths such as food or milk would further restrict the allowable intake via the domestic water supply.

As we have seen, there are a number of possible paths of intake of radium and of strontium-90 in the Durango-Farmington area, but there is very little actual data regarding the extent of human intake by these various routes. It is not possible at this time to estimate the total intake with any acceptable accuracy. Only by means of additional sampling and analysis can we accurately assess the degree of local radiation exposure and the contribution made by radioactive waste discharges from the uranium refinery at Durango, Colorado.

Proposed Fact-finding Survey

In view of the present uncertainty as to the amount of radiation exposure in the Durango-Farmington area, and the resulting uncertainty regarding acceptable levels of radioactive waste discharge to the Animas River from the uranium refinery at Durango, Colorado, the fact-finding survey outlined below is suggested for immediate performance. The objectives of the survey are:

(a) To evaluate the internal radiation exposure to radium and strontium-90 in the Durango-Farmington population area, and the portion of this total

exposure that results from radium and other waste discharges from the Vanadium Corporation of America uranium refinery at Durango, Colorado.

(b) On the basis of the above evaluation, to assess the interstate pollutional aspects of the uranium refinery waste discharges, to estimate an allowable upper limit for waste discharges, especially radium, from this refinery, and to suggest any necessary remedial measures.

In keeping with the aim of accomplishing the above objectives as quickly as possible, the following tentative sampling schedule is proposed; as information accumulates, sample types and frequencies will be altered to best accomplish the foregoing objectives:

(a) Raw water and tap water at Aztec and Farmington, New Mexico; these samples to be composited weekly during periods of low stream flow and monthly during other periods.

(b) Filter sand from the sand filters at the Aztec and Farmington, New Mexico, water plants; monthly, before cleaning the filters; other samples indicative of contamination of the water plant equipment, as desirable.

(c) Fruit and/or vegetables from three or four representative farms that use the Animas River in important degree for irrigation; to be collected at a frequency in keeping with crop development, possibly monthly.

(d) Farm topsoil from the above farms; to be collected before and following the irrigation season and at desirable intermediate times.

(e) Milk and possibly other food samples; to be collected monthly and composited if feasible.

(f) Animas River samples of water at stream sampling stations located immediately above and below the Durango refinery, at the Colorado-New Mexico boundary, and probably at one or two additional stations in New Mexico; these samples to be composited if at all possible and to be collected monthly and possibly more frequently during low flow periods.

(g) Animas River mud samples: to be collected in representative fashion monthly at the stations noted in (f).

(h) Animas River biological samples: to be collected in representative fashion monthly as available at the stations noted in (f); to consist of algae or plankton and bottom insects; fish samples to be collected quarterly at the station above the refinery, at a representative location below the refinery and in New Mexico below the Colorado-New Mexico boundary.

(i) Effluent samples from the Durango refinery; to be composited and collected monthly, to coincide if possible with the river sampling schedule.

(j) Precipitation samples (rain and snow); to be collected as available at Durango and Farmington.

In addition to the foregoing routine sampling schedule, several brief more intensive surveys should be made. These surveys might be of two to four weeks duration, and should be timed to coincide as well as possible with both

seasonal and low flow patterns. During these surveys more extensive data on all of the above sample types should be obtained as base material for interpretation of the routine but infrequent sampling outlined above. The first and most extensive of these surveys should be performed during the summer of 1958.

During one of the above field surveys a study of the uranium refinery process should be carried out. At this time, probably the summer of 1958, bioassay studies of the toxicity of potential and actual refinery effluents should also be performed.

The foregoing samples should generally be assayed for gross radioactivity, for radium, and for strontium-90 on a selected basis. Uranium analysis is probably not necessary except for a few isolated samples; the MPC for uranium is quite high, and reason as well as the limited data available indicate that uranium releases as waste are relatively quite small.

Many of the foregoing types of samples are cumulative by nature, and it is for this reason that some types can be grab samples at relatively infrequent intervals.

The duration of the routine sampling program, because of seasonal water uses and because of the nature of radiological hazards, should be one year with a somewhat reduced program extending into a second year. It is anticipated, however, that considerable significant data should be available well before the completion of the program outlined.

Sampling on a routine basis should commence as soon as possible. It is expected that the suggestions of other agencies as well as field circumstances may to some extent modify the course of the investigation. It is suggested that the operators of the Durango refinery and the U. S. Atomic Energy Commission, as well as the States of Colorado and New Mexico, be invited to cooperate and participate in the studies.

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MR. STEIN: For the purpose of the record, I notice that you have several tables and a bibliography. I would suggest that, if you can, give a copy of your tables to Mrs. Price and she will insert the tables and bibliography in the appropriate places in the record.

Before we continue with comments from the State agencies, we should like to have a brief pause for a photograph, which I understand is desirable because we have some folks here who would like to take some pictures. Let's take a coffee break for ten minutes.

R E C E S S

MR. STEIN: May we reconvene? Before we get on I would like to introduce Doctor Weber, Regional Medical Director, Public Health Service, Denver, who has just arrived. - Doctor Weber.

At this point I should like to call upon the conferees and ask if there are any comments or questions that they wish to make or raise relative to the statements of Mr. Krause or Doctor Tsivoglou. Colorado? - New Mexico? Do you have any questions or comments?

DOCTOR CLEERE: I have a question, Mr. Chairman. Is it definite that the study referred to by Doctor Tsivoglou will begin this summer? I have reference to the study of the Animas River.

MR. STEIN: Yes, it is definite that this study will begin this summer. I think if the study is suitable to the other conferees, definitive arrangements probably will be made at this time and subsequent to this meeting. Now, as I have indicated, the Public Health Service, in interstate pollution problems, recognizes its responsibilities, and once having decided to get started, have a way of going on to a definitive conclusion. The Public Health

Service has budgeted and set aside money and has committed personnel from its own staff, to do this, as will be developed subsequently. We are hopeful for as much participation as we can get from the States concerned, but in any event we will definitely plan this subject to further consideration.

Are there any other questions?

DOCTOR CLEERE: Will this be a comprehensive study?

MR. STEIN: Yes, within reasonable limitations. I might indicate to many of you folks the magnitude of the type of study we contemplate here. Because of the significance of this problem, and because of the fact that this, I think, is the first time any State or Federal agency has really considered the problem of radioactivity as a pollutant, in an active case, the Public Health Service has definitely set aside $40,000 for this study. Now, I think that is a relatively minimum cost in that we are not thinking in terms of the regular salaries of the group who will participate in this project as a greater part of their job. So, I think we will have a fairly complete evaluation of the problem.

DOCTOR CLEERE: Would you venture a guess as to the duration of the study?

DOCTOR TSIVOGLOU: Almost all of the regulatory statutes indicate that you should be concerned with the available exposure to radium for a year or longer period. For this reason, I think the routine sampling program probably will have a duration of possibly a year to a year and a half. I believe the intensive work that should be done this summer should make available enough data within, say, six or seven months, so that any necessary remedial measures could be considered about that time. Does that answer it?

DOCTOR CLEERE: Yes. I have one other question, Mr. Chairman. Will the timing of the second conference be related to the findings of the survey?

MR. STEIN: The proposal we have to make is that if Doctor Tsivoglou's suggestions are considered, very little would be accomplished by the conference without additional data; and what we are faced with is a situation where we have to gather more data now. However, we are also faced with a fact; that is, the possibility that the State of New Mexico may be subject to an interim hazard, being the recipient of a radioactive pollutant. During the survey the cumulative effect of the pollutant may so rise that it may take a long time to get rid of it. So, what we are thinking in terms of, as well as the study group, is that they would make recommendations or positive suggestions, even though these may be interim suggestions; that we then consider reconvening the conference to decide whether conferees would recommend action based on these recommendations, if that were so warranted. This development has arisen in the last few days, and if this is the case we will proceed along this line.

To give effect to New Mexico's suggestion, we will call another session two to six months from now and see if we can agree on interim remedial measures and related recommendations. Later, we will call a third session to see what recommendations the conferees want to make for a long-range solution of the problems.

I would like to indicate as far as Public Health Service is concerned, the fact that this conference has been convened does not mean the problems are

all going to be resolved. The States may very well continue to see what is occurring and the remedial action that may be indicated, if remedial action is called for.

Does that answer the question?

DOCTOR CLEERE: Was it your intention at this time to have a general discussion period; meaning, is it in order for other questions to be asked from the other representatives from Colorado, or any member of the audience?

MR. STEIN: At this time perhaps Mr. Gahr may have a question to ask. These folks will have an opportunity to speak after the conferees have given their statements.

MR. GAHR: I will defer mine -

MR. STEIN: Do you have any questions or comments, Doctor Leland?

DOCTOR LELAND: None except this; - your study is going to be limited to an area between Durango and Farmington, as I understand?

MR. STEIN: Doctor Tsivoglou, is that correct? Is the study to be limited to an area from Durango to Farmington, for this purpose?

DOCTOR TSIVOGLOU: I would say that unless there are very definite problems, depending largely, I should think, on possibilities of more water or less water, as the case may be; then the survey would center around the area concerned.

DOCTOR LELAND: I would like to repeat Doctor Cleere's question. When do you think this study will get underway?

DOCTOR TSIVOGLOU: I would like to see it get underway as soon as possible. I would like to see some of the routine sampling started within a month, and I would like to see the intensive work started in July.

DOCTOR LELAND: You would of course call upon the two States to assist in any possible manner -

DOCTOR TSIVOGLOU: Yes, to some extent we would depend on assistance from the States.

MR. STEIN: We would like to have assistance from the States, this being a cooperative State-Federal study.

DOCTOR LELAND: That is what we also should desire.

MR. CALDWELL: The only other point I would like to make, is to confirm very fully what Doctor Cleere has established, that recommendations for corrective action could be made in the early stages of the study, if so indicated, as data is developed. Because of the nature of the problem we feel it is important that recommendations be developed in the interim period before the final report is made.

MR. STEIN: Fine. May we then call on Doctor Leland, Director of Public Health, New Mexico, for a statement from New Mexico?

DOCTOR LELAND: I should like to just re-affirm that which you have heard, which I think points out the significance of a potential hazard; one which does concern the State of New Mexico as well as the State of Colorado. For the technical side of the pollution problem in addition to the radioactive aspect which we have discussed, I should like to have Mr. Charles G. Caldwell, our State Sanitary Engineer, discuss the matter.

MR. CALDWELL: Thank you, Doctor Leland.

The Animas River flows through Durango, Colorado, and then across the State line into New Mexico. About fifty miles below Durango, Aztec, New Mexico, with a population of about 6,000 derives its drinking water from the river after treatment in a conventional water treatment plant which includes coagulation and filtration. Farmington, a town of about 22,000 population, is located at the confluence of the San Juan and Animas Rivers, about fourteen miles below Aztec; and again, the river water after conventional type treatment, is used for domestic purposes. The waters of the Animas co-mingled with the San Juan River flow are used by Navajo Indian facilities and private users as the San Juan continues on out of New Mexico and into Utah, and then into Arizona.

These river flows are of tremendous importance to the economic development of this area. Gas, oil and mining developments have resulted in a tremendous population and industrial gorwth, with the end not yet in sight. In fact, all indications are that the rate of activity will continue to increase for several years to come. This will necessitate increasing utilization of waters from both the Animas and San Juan Rivers, both above the confluence and below. As a part of our water pollution control program, designed to maintain these waters in satisfactory condition for further downstream multiple use, the Town of Farmington completed a new primary and secondary sewage treatment plant. The Town of Aztec project, now underway, is designed for the same purpose.

If the quality of this water is to be suitably maintained, however, consideration must be given to upstream factors where discharge of municipal and industrial wastes may be causing degradation.

In this connection it came to our attention, as a result of a report under date of November, 1954, entitled, "Comments of the U. S. Public Health Service on the Status Report of the Animas-La Plata Project, Colorado and New Mexico", Department of Health, Education and Welfare, San Francisco, published April 4, 1955, that the Town of Durango was using primary sewage treatment only. The report states that the Colorado State Health Department had advised replacement of the treatment facilities at that time. It is our understanding that this has not been done, and that the town has grown considerably, thus further overloading this inadequate treatment plant.

The report also indicates that untreated domestic sewage is discharged into the Animas at Silverton, a condition which we understand has not been corrected.

There has also been some question on the part of the San Juan County Health Department of New Mexico as to the location of municipal dumping areas on the lower Animas in Colorado, and the possible effects on the receiving stream. Although secondary to the municipal sewage disposal problems outlined above, this matter is worthy of some investigation to either justify corrective action or dispel cause for further concern.

The primary industrial waste problem centers around a uranium ore processing mill located on the outskirts of Durango. The Summary Report on Quality of Interstate Waters - Animas River, developed by the Water Supply and Water Pollution Control Program of the Public Health Service, January, 1958 shows that a grab sample taken from the tailings pond effluent had a soluble radium content of 25 uuc/l, another sample showed 0.2 uuc/l above Durango, while a third sample taken below Durango, which would be after dilution, had a level of 3.3 uuc/l. This may be especially significant, as it is our understanding that the maximum level in the effluent should not exceed 4 uuc/l. The flow in the Animas River at Farmington varies from around 5 cfs to over 20,000 cfs; consequently, there is not a uniform, year-around dilution factor.

Although radium is a primary cause for concern, some thought must be given to gross Alpha and Beta activity. The 1955 report lists a total gross Alpha below Durango at 34 uuc/l, and a total gross Beta of 26 uuc/l.

The Colorado State Department of Public Health which has shown full understanding of our concern and has given full cooperation, informed us that three samples were picked up from the Animas River in the vicinity of Durango in June, 1957. In Sample R-2 Beta activity was reported at 260 uuc/l. A sample picked up in February, 1958, by this agency at a point at least one mile below the mill discharge, had a suspended activity of 158 uuc/l, and a dissolved activity of 26 uuc/l.

We do not feel that the results of analyses made to date are conclusive, but we do believe that the data collected so far, from all sources of information, is significant in pointing out the existence of a problem which should be investigated before it develops further or causes undue pollution to the detriment of downstream users. In this connection the industrial waste problem can be divided into two parts. One, the current levels of chemical and radioactive waste materials being discharged into the river; and two, the location of a tailings pond, containing considerable quantities of radium, in close proximity to a river used as a source of drinking water. The significance of these two factors could be of considerable importance in terms of long-range public health protection.

After careful consideration of all of the above, and because of the continued rapid development of this area which to a great extent depends upon an assured supply of acceptable water from the Animas and San Juan Rivers, the New Mexico Department of Public Health has formally requested the Department of Health, Education, and Welfare, Public Health Service, Regional Office, Dallas, Texas, to arrange for this conference with a view to providing an opportunity for free discussion of all salient points by all agencies concerned, and further to request that Public Health Service institute a water pollution survey of the Animas River, such survey to include biological, chemical physical and radioactive waste studies as well as municipal and industrial plant surveys and evaluations; all of the proposed work to be directed toward protecting the quality of the water of this interstate stream.

MR. STEIN: Thank you, Mr. Caldwell. Do you folks in Colorado have any comments or questions on the New Mexico statement?

MR. GAHR: Just so that we fully understand each other -- by conventional water treatment, exactly what do you mean by rapid sand filters, coagulation, etc., the complete process? In your opinion do you feel that this type of water plant

processing, conventional treatment, can cope with unconventional types of wastes that contaminate the water?

MR. CALDWELL: I do not want to say that it will cope with radioactive wastes, I have not seen enough evidence to indicate that.

MR. GAHR: You mention that Aztec and Farmington have secondary treatment for their domestic sewage. When their new plants are constructed, did you state that they will both have primary and secondary sewage treatment for their domestic sewage?

MR. CALDWELL: That is correct.

MR. GAHR: Thanks.

DOCTOR CLEERE: The studies conducted to date by the Colorado Department of Public Health are certainly inadequate as far as any conclusive findings are concerned.

MR. KRAUSE: As Mr. Caldwell mentioned, concerning the possible rapid growth of the industrial and economic potential of the San Juan-Animas basins; I should like to have him enlarge upon that as to what the potential for this river appears to be.

MR. CALDWELL: That area is really one of the last major areas for development, I could say, in the West; at least it is one of the last large areas of New Mexico where there are still water rights on the Animas River that can be obtained for irrigational and industrial purposes. There has already been, as I have noted, a tremendous increase in population in Aztec and Farmington as a result of the oil and gas developments. You may have read in the papers that there is another pipeline being approved, and another one applied for. In addition, today we have a report by a construction company which states that they have applied for 139,000 acre feet of water annually for industrial development. Included in the suggested industrial developments are Nitric Acid production, Manganese mining, electric generating plants, possible food processing and other activities.

The way it works out, we can expect that the area from Gallup on up through Farmington and Aztec is going to really develop. It is going on right now, and that means more and more water use for those industries already there and those that will be established.

MR. STEIN: Mr. Krause, do you have any more questions?

MR. KRAUSE: No.

MR. STEIN: May we call on the Colorado State Department of Public Health at this time? Doctor Cleere, would you speak on the sources of pollution and measures of control being instituted?

DOCTOR CLEERE: Mr. Chairman, before proceeding, and if it is in order, I would like to call on Mr. Gahr to introduce other Colorado representatives who are present today for the conference.

MR. STEIN: That would be fine, but we suggest that they speak later as we have a place on the program for the other participants, and if you think

it would be appropriate, we can call on them then.

DOCTOR CLEERE: Yes, that will be all right. I wish to say that the statement I am about to read was prepared by Mr. William Gahr, Director of the Division of Sanitation, Colorado State Department of Public Health. There are copies of this statement available, and I will ask Mr. Gahr to distribute copies at this time.

An inspection of the Animas River drainage area upstream of the Colorado State line was made in April, 1958, to determine the general nature of pollution going into the Animas River.

The Animas drainage area begins above Silverton, Colorado, and extends south into New Mexico. In Colorado the basin is approximately seventy-five (75) miles long and fifteen (15) miles wide.

Pollution in the Animas River results from domestic sewage and industrial wastes which receive varied stages of treatment.

Silverton, Colorado, (population 800) discharges raw domestic sewage into the Animas River from approximately 600 people connected to the sewer system. The location of the open city dump is approximately 150 feet from and above flood level of the Animas River.

The Pride of the West Mill above Silverton does custom milling of complex ores.(Complex ores are Cu, Zn, Pb, Au, Ag.). The mill capacity is 85 tons per day. The tailings ponds are two to three hundred yards from the river, and there was no visual evidence of stream contamination from the ponds at this inspection.

Durango, Colorado (population 11,500) has four municipal septic tanks and two Imhoff tanks, the effluents of which go directly to the Animas River. The Clover Rich Dairy which processes approximately one thousand (1,000) gallons of milk per day, a garage and offices occupying the same building, have a private septic tank discharging into the Animas River.

Plans and specifications for a complete sewage treatment plant have been received by the State Health Department and U. S. Public Health Service by the City of Durango. It is planned that construction of the plant will begin in 1958. The new installation incorporates the connections of all lines, both municipal and private, which are now discharging into the river.

South and east of Durango the City operates and maintains a sanitary landfill. The operation of the landfill is such that no trash is carried to the river as a result of runoff.

Immediately south of Durango is a small industrial area including a lumber mill and meat packing plant. Each industry has its own sewage or waste disposal system with no direct lines to the river.

Information received from the Vanadium Corporation of America indicates the plant at Durango has individual sewage disposal facilities in the form of septic tanks with one known septic tank effluent line going directly to the river. Undetermined amounts and kinds of trade wastes from the mill are discharged directly to the river. The mill processes approximately four hundred (400) tons

of ore per day. According to the officials of V.C.A., closing the Naturita plant will increase the load to the Durango mill by two or three hundred tons per day.

Thank you.

MR. STEIN: Thank you, Doctor Cleere. Are there any questions or comments from New Mexico?

DOCTOR LELAND: What is the water supply of Durango?

DOCTOR CLEERE: I will ask Mr. Gahr to answer that question.

MR. GAHR: Their supply consists of raw water source from the Florida River where they have an intake. As the population has increased, Durango has been developing another domestic water line to the Florida River and may have to turn to other sources.

The raw water comes to a holding storage reservoir which was created by construction of an earth tank. The town has also constructed a conventional water treatment plant from which water is piped down to the normal type of distribution system. I would like to add that part of the distribution system includes reservoir storage of finished water. Most of these storage facilities are completely closed and covered. One, however, on a hill adjacent to the college down there, is an open earth lined reservoir, and this is scheduled to be replaced sometime in the future. This is the only not-normal type or unconventional unit in the distribution system.

DOCTOR LELAND: This Naturita plant which you speak of -- they contemplate closing it?

MR. GAHR: That is my understanding. We do have some representatives from the Vanadium Corporation of America here in the audience, who could give us more complete data on that.

DOCTOR LELAND: This is the first time we have heard of an expansion of the Durango plant.

MR. STEIN: I would suggest that we wait for their statement.

DOCTOR LELAND: I would appreciate it. That is all I have --, Mr. Caldwell, do you have any comments to make?

MR. CALDWELL: None at this time.

MR. KRAUSE: I note that plans and specifications have been received by the Colorado State Health Department and Public Health Service for a complete sewage treatment plant at Durango. Has the financing for this been arranged; that is, for the construction work?

MR. GAHR: No. The financing does hinge on a Federal grant. It is true the plans and specifications for final construction were received by our office in January, and have gone to Public Health Service. We have approved the eligibility of this plant for Durango. It now awaits the Grant funds which are at this stage not yet appropriated, and we feel that Durango will receive priority as soon as we have knowledge of the appropriation of these funds.

MR. KRAUSE: If they receive them, could they proceed immediately?

MR. GAHR: They have agreed to proceed. They say that construction can start in forty or fifty days after they have received the Grant agreement and have accepted it. It takes time for advertising and letting the contract. They further estimate that the plant will be completed in 450 days, or in other words, it would go into operation about October 1959, I believe.

MR. KRAUSE: The plant at Durango -- is that to be conventional type?

MR. GAHR: The deal under discussion in Durango? -- Well, there is a possibility of asking for a modification to the plans, because of changing the plant location, which will change the way of handling the sewage at the plant.

MR. STEIN: Do you anticipate that the people from Durango will want to make a statement to that?

MR. GAHR: Officially I have not found any of them present in the audience. They might have arrived later.

MR. STEIN: Just to get the record clarified in relation to sources of pollution, - is the packing plant in your opinion a source of pollution of the Animas River at this time?

MR. GAHR: Not at the present. There are several other mining operations or industries which have been in operation or leased at various times in or near Silverton, Colorado, one of which was the Pride of the West Mine.

MR. STEIN: I would like, for the record, to ask if you have any information on the operation of any other mines or mills, as a significant source of pollution at this time.

MR. GAHR: Not at the present time. It is my understanding that they are shut down.

MR. STEIN: Thank you. I think we can go on.

Next on the agenda are statements by the Atomic Energy Commission. As I have indicated, all other participants have been invited by the State agencies, and I might ask New Mexico - have you asked or recognized any of the AEC folks who are here?

DOCTOR LELAND: There are several here from Albuquerque; they probably have their own choice as to who shall speak; and I believe also representatives from Colorado are here.

MR. GAHR: We invited someone from the Grand Junction Office; Mr. McGinley was to come -- from the Raw Materials Division.

MR. STEIN: Is Mr. McGinley here? - Yes.

MR. MCGINLEY: I do not have a prepared statement for the record. The Grand Junction Operations Office would like you to know that we are willing to cooperate to the fullest extent in any surveys or programs of this type.

I would like to be kept informed of the programs or any action recommended, whether by State or Federal agency, in this regard. Other than that, we do not have any prepared statement.

MR. STEIN: Are you speaking for the Raw Materials Division?

MR. MCGINLEY: I am speaking for the Grand Junction Operations Office.

MR. STEIN: (Recognizing Doctor Walker) Would you please identify yourself?

DOCTOR WALKER: I am Doctor Walker, from the Idaho Operations Office. I have most of the mills in the Colorado-Utah area, as most of the uranium mills are assigned to the Idaho Operations Office for inspection. We are a group who merely make inspections of the mills and make recommendations for correction of any violations which may be found. Our recommendations are forwarded to the Division of Licensing and Regulation, who has control over the licensing for compliance with the regulations.

I would like to introduce Mr. Robert Barker, AEC., Division of Licensing and Regulation, Washington, D. C.

MR. BARKER: I would like to say, as a representative, that we also cooperate to the fullest extent with both the State and the Public Health Service in the control of pollution.

MR. STEIN: Thank you. Before Mr. Barker goes on, for the record, I would like to ask the first gentleman who spoke, from Grand Junction, to give his full name. Please identify yourself and your position each time you speak.

MR. MCGINLEY: Frank G. McGinley, Raw Materials Division, Grand Junction Operations Office, Grand Junction, Colorado; and this is Dr. D. I. Walker, Idaho Operations Office, Idaho Falls, Idaho.

MR. BARKER: Robert F. Barker, Division of Licensing and Regulation, Headquarters, Washington, D. C.

I would like to add two things. We are, as you can guess from the title, in the business of licensing and regulating the mills. In this respect, uranium mills fall in this category and are subject to the regulations as issued. In addition, we have recently completed a very sketchy survey of the mills, and this information was made available to the Public Health Service. We, again, would echo the words, that we would like to cooperate, but would like to be kept informed.

MR. STEIN: Is anyone here from the Albuquerque Operations Office? -- Mr. Haycock?

MR. HAYCOCK: Thomas J. Haycock, Albuquerque Operations Office, also in the Division of Inspection.

We are here from Albuquerque primarily for information today, inasmuch as the Durango plant falls under the auspices of the Idaho Operations Office. We are very happy to cooperate with the State agencies, and we hope that Mr. Caldwell and Mr. Jensen will call on us to help, or let us cooperate with them in this work.

MR. STEIN: Thank you. Is there anyone else from AEC who wishes to be recognized at this time? I think I can assure you gentlemen that it is a policy of the Public Health Service to keep the AEC informed of the operations here. I might refer to Doctor Tsivoglou's statement when he asked that the AEC be invited to participate in this study as well as the States; this is something which you and the conferees may wish to consider. I would suggest that we, if the conferees think this is appropriate, in the meantime leave the invitation open so you can check back with home base and discuss it among yourselves. You can, when the findings of the study are being developed, decide what you want to do -- whether or not you want to participate.

Do any of the other conferees have any questions or comments to make on the AEC statements?

MR. GAHR: I would like to ask a question of the AEC representatives. One is, what is the force and effect of the AEC licensing upon the industry? - I mean the mills? What force and effect do regulations have on controlling them in administration of the quality of the effluents they have to discharge?

MR. STEIN: Again, identify yourself for the purpose of the record. I might say this is for all participants each time they speak.

DOCTOR WALKER: Don Walker.

The regulations as of now, which are Title 10, Part 20, "Standards for Protection Against Radiation"; Section 20.103 is the control of effluents released to unrestricted areas, in which category the mill in question, in Durango, would fall. The part and section outlines the amount of radioactive materials by individual isotope which can be released into any area, such as the Animas River, over which the licensee does not have control.

The limits specified for the isotope in question are 5×10^{-11} mc/ml natural uranium, 2.4×10^{-12} mc/ml for radium, and 8×10^{-8} mc/ml for Strontium. Let me say, these are a little bit lower limits than are specified in Handbook 52, for release in unrestricted areas.

MR. GAHR: I would like to ask one more question -- Could you tell us in general terms, what the AEC is now doing in finding out how well licensees comply with your suggestions?

DOCTOR WALKER: Yes, I can. The inspection of the mills was started approximately in the past six months. The first inspection was made in December 1957. There are seventeen operating mills at the moment, with nine under construction throughout the country, the larger of course being in the Colorado-Utah and Grants, New Mexico areas.

It is not a policy of the AEC to go in and make a survey of the licensee. We feel this is a responsibility for administration. What we do, is to see if the licensee is keeping record of the operation, and it will be up to the Commission to then determine whether or not the license is in compliance with the regulations. We do not make the survey. There are times when we make a spot check. It is up to the licensee to furnish the results that the Commission has requested with regard to compliance.

MR. GAHR: Is that information available to other agencies? Would it be available to the Colorado State Department of Public Health?

DOCTOR WALKER: Whenever we can, out on these inspections, we not only invite the State Health Departments, but encourage them to make the inspections. The results which we have obtained go to the licensee as well. These are considered for AEC internal use for control of license material for licensees. However, I see no reason why in Colorado you could not have access to these records.

DOCTOR CLEERE: I want to introduce Mr. Jack Torrey, Industrial Hygienist, Colorado Department of Public Health. If it is agreeable, I would like for him to participate in the discussions.

MR. TORREY: I have a question, more in the nature of a statement. It is my understanding that inspections in Colorado of the mills and processing plants have been conducted jointly by AEC representatives and the State Department of Public Health, which we think is an excellent working relationship between AEC and the State Department of Public Health. A question please? -- If during a joint inspection by the AEC and the State Department of Public Health, there are definite violations detected in a given plant, then which agency is responsible for enforcement of standards and regulations?

DOCTOR WALKER: I think this is pretty clear cut. We are strictly a fact-gathering group. Our results are forwarded to the Division of Licensing and Regulation, the organization which has the enforcing power. We do not have the power for enforcing the regulations.

MR. BARKER: Barker, AEC, Washington.

Perhaps I can speak a little more directly as to force and effect. The AEC Act, established certain requirements for the process and use of certified materials in the Act. Included in these definitions was source material, which is uranium and thorium. The uranium, which is processed in the mills under discussion, at least most of the mills, are included in this definition of source material, and therefore are subject to the licensing control of the AEC.

This control is effective to give a regulatory program which involves two, I should say three, phases. (1) Simply desiring license issuance; (2) The license is based on an application in which information is given regarding the proposed use, the description of safety precautions and definition of the control of the material. The license is issued for processing the raw uranium ores and use of the refined material through processing and milling. It is then the inspection function which reviews the operation in the mills with regard to their compliance with the regulations.

Third phase; the Production Division has regulations which set forth the standards to which Mr. Walker referred. This is our purpose. Here is a Federal Register -- if you would like, I can submit this copy of Part 20 as part of the record.

MR. STEIN: Yes, thank you.

(FEDERAL REGISTER, Title 10, Part 20, entered as EXHIBIT "A")

MR. BARKER: The follow-up would be, as far as total compliance is based on, much the same procedure as a conference. A legal procedure which has been established is Part 20, of Title 10, "Standards for Protection Against Radiation". The licensee is notified of the alleged violations, and is given a period of time in which to comply; that is, to correct the deficiency. If the corrections are satisfactory, then there is no further discussion or no further need for action. If the corrections are not made, and a hearing is called, and I am short-cutting a little bit here; but I think it is sufficient to indicate that everyone is given sufficient opportunity to present their views in regard to continuance of the license or the correction of the deficiencies which have been found under the license. If these are satisfactorily resolved the licensee is permitted to continue. Otherwise, the license will be revoked or amended, as necessary, to enforce compliance with the published regulation. The effect, then would be the removal of the license, if necessary, which would not permit processing of the raw ore.

DOCTOR CLEERE: After a plant manager is notified of violations by the AEC, is it then the responsibility of the AEC to render consultation service to the industry involved in an effort to assist the industry in complying with the AEC Standards and Regulations, or do you consider that a responsibility, in Colorado, say, of the State Department of Public Health?

MR. BARKER: I will not side-step this, but I would rather suggest the position of the AEC in that they are quite willing to explain, as may be necessary, the intent of the regulations. Again, as a regulatory agency, it is necessary that they not be in a position of suggesting the exact method that one will use in complying with the regulations. If one were to do that, it would then be a position of inspecting against his own suggestion. For this reason, we suggest the intent of the regulations, the deficiencies as we understand them, attempt to clarify them as much as possible; and again not provide services for the licensee which are available commercially or from State groups such as you, or Public Health Service. We realize they all depend on you primarily.

MR. STEIN: May I clarify one point here? We are not in the business of competing with consulting engineers. We are a regulatory agency, for the purpose of letting the appropriate engineering firms come up with the solutions, rather than the regulatory agency providing such services.

DOCTOR CLEERE: As a State agency, I have qualified personnel to render the consultation services referred to. Therefore, it would be desirable to call on the State agency to render that type of consultation service to the industry involved in the violation of standards and regulations.

DOCTOR WALKER: The responsibility for compliance of the matter lies wholly with the licensee. If they can obtain this from the State Health Department it will be acceptable by us. On the other hand, if they obtain the service from any private concern, the responsibility lies wholly with the licensee to obtain the information contained in the regulation. We are quite satisfied - we are not trying to impose, therefore on the State Health Department. Again, we point out, it is the responsibility of the licensee to obtain this information to comply with the regulations.

DOCTOR CLEERE: Thank you. That clarifies the question. At this time I would like to call on Mr. Torre.

MR. TORREY: J. D. Torrey, Colorado Department of Health.

I would like to ask Doctor Walker to clarify his figures that he gave. I think you gave the ones for air -- would you like to give the ones for water?

DOCTOR WALKER: I did quote the figures for air; the water figures I did not quote. They are in the Table of Title 10, Part 20.

MR. STEIN: Do we have any comments or questions from New Mexico?

DOCTOR LELAND: A question which I think should go in the record -- Must a licensee comply with existing State regulations having to do with water pollution?

DOCTOR WALKER: We have certain regulations which are imposed on the licensee by Federal regulation. There is nothing in the regulations which precludes a State from putting more restrictive measures on a licensee if it should desire. It is doubtful that a State would put on less restrictive measures. There is nothing to prevent a State agency from putting on more restrictive regulations.

DOCTOR LELAND: In that case, consider a State Department making a certain survey, feeling that their regulations were violated; would the course of appeal be through AEC?

DOCTOR WALKER: If the licensee were in agreement with the AEC regulations, it would then become strictly a State problem.

DOCTOR LELAND: In the case of a complaint by a State, wherein, perhaps they feel that even two regulations were violated - would the course of action be through AEC or direct to the licensee?

DOCTOR WALKER: We would feel slightly embarrassed if the State found that what we had approved as being O.K., was not in compliance with State regulations. We would do the utmost to get the licensee in compliance, as so written.

DOCTOR LELAND: We have at least three experiences with the Colorado State Health Department in testing this particular situation. Do you have more data? You have conducted a series of tests around this Durango mill.

DOCTOR WALKER: A series of tests - mostly spot checks. The New York Health Department Safety Laboratory has conducted some preliminary surveys. The results of these surveys were obtained from mine mills. The intent of the survey made by the Health and Safety Laboratory of New York was not connected in any way with the inspection program. The Division of Biology and Medicine attempted to obtain data which would give them a background of hazards relative to the uranium industry; not only milling, but processing and similar situations. The information which they obtained from the mills will not be used against the licensee for compliance with the regulations. This point should be made clear to Mr. Brinker.

DOCTOR LELAND: Such data, however, could perhaps be made available if desired on this survey, for survey purposes alone.

DOCTOR WALKER: The information as obtained by the Division of Biology and Medicine has been turned over to the Division of Raw Materials for use as they see fit. The information will be compiled into a composite report, of all the mills which were surveyed, and which may be surveyed in the future, giving the ranges not only of the air tolerances, but the water as well, for each of the various processes throughout the milling industry. Most of the survey thus far has been concerned primarily with the concentrations of air-borne activity within the mill, some of course has been done with the effluents of the mill.

MR. BARKER: In direct answer to your question, the information which we had obtained was directed to the Public Health Service. Doctor Tsivoglou was call in and looked over the data. Because of its spot sampling nature, the particular item under which this survey was conducted was to determine environmental problems primarily, rather than in-plant conditions. Doctor Tsivoglou felt that this information was not necessarily sufficient to add much to his previous data, so he had not included it.

MR. CALDWELL: This material that has just been mentioned is really in the nature of research. Going back to the original statements, as I understand the working of AEC, does the licensing division of AEC really expect the industry to police itself and keep records which would show that they are in accord with the regulations?

MR. BARKER: Yes, that is about it.

MR. STEIN: May I ask the AEC representatives a question? According to the regulations, is the Animas River an unrestricted area?

DOCTOR WALKER: According to the area over which the licensee has no control, not including the interior of the plant and facilities; therefore the limits in this particular case are considerably restricted.

MR. STEIN: As I understand the physical limits of the plant at Durango, the Animas River is outside the area.

DOCTOR WALKER: That is correct.

MR. STEIN: We have obtained a copy of the license issued to the Vanadium Corporation of America, R-102, issued in November, 1957. It says this license expires December 1, 1958, and is subject to all the provisions of the AEC Act of 1954, and all valid rules and regulations relative to isotopes. Is this license still in force and effect?

DOCTOR WALKER: Yes. Most of these source material licenses are issued on a one-year basis. However, most of the mills which are contracting for uranium, have contracts with the Division of Raw Materials, and most of these contracts are in effect until 1962. Some of the newer licenses, when they have been re-issued or renewed, their expiration date has been made to correspond with the contract, - in this case 1962.

MR. STEIN: Is the statement that the expiration date will be extended to the contract date, correct?

MR. MCGINLEY: That is correct.

MR. STEIN: Can we assume that you did not consider the license to be in violation of the regulations since the license is in force?

DOCTOR WALKER: What do you mean by license --

MR. STEIN: If the license were in violation of the regulations as prescribed, the license under your regulation, there presumably would be some sort of action for corrective measures or something to remove the license, since this license is in full force and effect. -

DOCTOR WALKER: I am not speaking of the Durango mill, but of all mills. No mill has as yet been in compliance with the regulations inasmuch as these place the responsibility on the licensee to determine the various limits, for not only air-borne activity radiation levels but effluents released to unrestricted areas. Most of the companies only keep the limits of their effluents discharged. We have cited them, however, for failing to determine the concentration of radioactive material in the effluents released in the unrestricted areas.

MR. STEIN: This citation has not resulted in removal of the license? -

DOCTOR WALKER: No. --

MR. STEIN: What is the procedure if a mill is cited for not being in compliance?

MR. BARKER: Conferences usually can be resolved in a relatively short period of time; other actions of a regulatory nature frequently require a longer period of time. This is the case with the mills. The initial inspections were made slightly less than six months ago. The follow-up action which I very briefly sketched to you before, usually has had to be fully taken care of through conferences and correspondence. Therefore, perhaps we are jumping the gun, so to speak, to say that an actual citation has been made, because in Washington the piece of paper has not gone to the licensee yet. When this is done there will still be a period of time during which the conference table, this time by correspondence, will be participated in by the Division and the licensee. The consultation on the action cites the responsibility of the licensee, the action which is indicated. Any follow-up inspection which will probably be necessary, in this case since there was not data from a survey to examine from a first inspection, will take a period of time. I might suggest as to the period of time necessary; it looks like it might coincide with the survey that is being directed today. Therefore, removal of this license will probably depend in part on the licensee's action with regard to his initial letter, which he will write.

MR. STEIN: May I ask one final question? I understand that by December 1, 1958, the licensee may be in position to get a license for the duration of his contract; that is, over a period of three or four years, until 1962, without a determination being made on anyone's part that the licensee is in fact in complinance with the terms of the license.

MR. BARKER: The compliance with the regulations is a condition for renewal; his license can be revoked at any time that he is determined to be in non-compliance. The mechanism is established for taking necessary action to either revoke, suspend or amend that existing license, if that is indicated. Therefore, if the wheels of this conference to which I referred, were so slow as to result in a renewal of this license prior to the time a determination

could be made of his compliance or non-compliance; it would then be possible at any time to revoke his license prior to the expiration date, which would be shorter than the four years. It is possible to take such action as might be necessary through the mechanism of amending or suspending the license. That is the way that we have of operating.

MR. STEIN: Thank you. Are there any more comments?

I would like to thank the representatives from the AEC for a very illuminating discussion of the problem. If I might comment now, I think you will recognize that both the AEC and Public Health Service have statutory responsibilities in this, and that our objectives are similar; and as this develops we could work together jointly in a reasonable way to carry out the responsibilities we have and the ones you have. I think the objectives are about the same.

For the record, I might point out that due to the responsibility we have under the law we are required to institute proceedings such as this, to arrive at an understanding of the problem and a method of procedure; in this case, radioactive waste discharges originating in Colorado which may endanger health and welfare of persons in New Mexico.

At the present time we would like to call upon the other participants. We would like to call on the Colorado conferees to introduce the folks they have invited. I shall ask the participatns to get up and identify themselves, and if they have a statement, to come forward. There are two alternatives for the participants: If you do not have a loud voice you may wish to sit here (indicating chair by microphone); if you feel that your voice can carry to the microphone, you may speak from where you are.

Doctor Cleer, or Mr. Gahr, would you call on your participants?

MR. GAHR: The Colorado Department of Public Health, formally, by letter, notified these participants, which I shall read, and later will call on those who have asked to be heard.

First, Mr. John B. Barnard, Jr., Attorney General's Office.

MR. BARNARD: Mr. Gahr, as you say, I am from the Attorney General's Office, currently working on the matters in question. I am here as an observer and have no statement.

MR. GAHR: Mr. Richard L. Moore, Colorado Game and Fish Department. Do you have a statement at this time?

MR. MOORE: Yes.

MR. GAHR: Will you come forward, please?

MR. MOORE: I have a statement representing the feelings of the Colorado State Game and Fish Department at this time.

At present, the Animas River is a poor trout stream. Mineral pollution is the greatest detriment to its trout environment. There are two main sources of the pollution. One, the old mines and mills in the Silverton

area, most of which are not operating, but continue to contribute to the poor water quality by erosion of mine and mill wastes. Two, the VCA uranium mill in Durango has virtually destroyed the trout habitat in the Animas River below that point by discharging mill wastes into the river.

The effects of these conditions in the Silverton area are insidious and sporadic. Historically, trout have never existed in North Mineral or Cement Creeks because of natural pollution of their waters from draining highly mineralized areas. The same is true of several small creeks above Eureka, an old mining camp above Silverton on the mainstem of the Animas.

Add to this the tailings washed into the river by rains and runoff from old mill operations which have been out of business for many years. Further, add more tailings which enter the river, either deliberately or accidentally, from mills still operating, at least intermittently in recent years -- it all adds to a very marginal trout habitat, lessened somewhat by dilution from each good stream coming into the Animas Canyon below Silverton. In other words, the water quality for trout improves slowly all the way to Durango. The majority of the trout are planted from Durango to Bakers Bridge, a short distance below the mouth of the Animas Canyon. A few trout are hauled into the lower miles of the canyon -- the upper portion of this railroad plant being discontinued in 1956 due to the poor water quality and resultant low fishing pressure. We do not anticipate more than a fair return to the creel of trout planted in the lower end of the canyon for the same reasons. Therefore, the section from the mouth of the canyon down to near the New Mexico line represents the most valuable part of the river from the trout fisheries standpoint.

However, approximately one-half this distance, beginning at Durango, has been largely destroyed by pollution coming from the VCA mill at Durango. Here, it is evident that the uranium mill is the major contributor of toxic wastes -- there are no other mines, mills, or naturally polluted areas that add significantly to the pollution below Durango, as was the case on the headwaters near Silverton.

In summary, there appears that nothing can be done to stop drainage of toxic substances from some of the smaller streams on the headwaters of the Animas River. Likewise, little or nothing seems practical to stop the same substances washing into the river from mine and mill dumps which abandoned operations long ago. On the other hand, any mill now active should not be allowed to further contaminate the river because there is contamination already present. Most important of all, the VCA should be forced to properly dispose of their wastes so that no toxic wastes enter the river. There are no State laws under which the Colorado Game and Fish Department operates that effectively cope with such stream pollution as now exists in the Animas River.

MR. STEIN: Do the New Mexico representatives have any questions?

DOCTOR LELAND: No questions.

MR. STEIN: Thank you very much.

MR. GAHR: Mr. Moore, I believe it was the import of this statement that the damage to trout was caused mainly or essentially by finely divided material coming from mine dumps and mills. Is that correct?

MR. MOORE: That is our belief. I might add that the Game and Fish Department has no long-range studies to support this situation. It is the situation as it exists.

MR. GAHR: I would like to call on Mr. McGinley, representing the Raw Materials Division, Grand Junction Operations Office.

MR. MCGINLEY: Thank you, Mr. Gahr. I believe that the AEC position in this matter has been adequately covered by those that preceded me.

MR. GAHR: I would like to call on any representative of the Durango Chamber of Commerce who may be present at this time. Is anyone present?

Is there anyone here representing the Durango city government? - Is there anyone representing the Silverton city government? - Is there any representative here from the San Juan Basin Health Department out of Durango?

We should like to call, then, upon Mr. John A. Maxwell, representing the Vanadium Corporation of America at Durango. They have a paper they would like to present. Would you come forward at this time?

MR. MAXWELL: I would like to introduce Mr. Fred A. Brinker of the Vanadium Corporation of America at this time.

This is a statement by the Vanadium Corporation of America, Durango, Colorado, for the U. S. Public Health Service conference in Santa Fe, April 29, 1958.

The company operates a vanadium - uranium processing plant at a millsite on the west side of the Animas River, just south of the city limits of Durango. This mill has been in continuous operation since 1948.

In the disposal of the various waste products from the mill, the company has recognized the importance of these waste products as related to pollution of both air and river. It has been diligent in its effort to comply with the laws and regulations relating to pollution.

In this work the company has had the cooperation of the local, state and federal agencies; and in the future will work with these agencies on any reasonable program for improvement of conditions relating to pollution.

Since 1956 all roaster gases have been treated by scrubbing and air pollution from this source is practically eliminated.

It has been the policy of the company from the start of its operation in Durango to impound the solid tailings produced. The coarser fraction of this tailing, which is about 95 percent of the total tailing, is no problem. The slime fraction is a problem and requires special handling to prevent its discharge into the river. During the last year a flocculent has been used in the mill which aids in the settling of this sline fraction.

In addition to the overflow from the tailings pond there is a liquid waste overflow from the plant. This contains some sulfates, chlorides, and small amounts of vanadium and uranium. At present this overflow contains an alkaline waste product in such amounts that the pH of the total overflow is alkaline.

A change in our processing procedure is to be made about July 1st that will change the composition of this liquid waste product some.

Quoting from "Report of Survey of Contamination of Surface Waters by Uranium Processing Plants, September, 1955", by Tsivoglou, Bartsch, Holaday, and Rushing:

"Uranium Ore Processing. Upon being received at a typical mill, the ore is processed for recovery of uranium and vanadium. Processing steps differ in detail at different mills, but in general involve crushing and grinding the ore, roasting, and leaching. The liquor is then subjected to heat and pH adjustment for separation of the uranium through precipitation of uranium salts, which are pressed to form "yellow cake". The vanadium salts are then precipitated as "red cake" by further pH adjustment of the filtrate from the separation process. The filtrate is then discarded. The "yellow cake" is fused to form "black cake", which is then crushed and washed. The sand is discarded as tailings, and the filtrate (which still contains some vanadium) is returned to the mill process. Sources of radioactive waste at a typical mill may include wash waters, the filtrate following precipitation of vanadium, sands and waste solids. Some part or all of the waste products may be stored indefinitely in a tailings pond pending possible future recovery of other minerals, but in one case where there was no tailings pond (see below) all wastes were discarded directly to a nearby stream. Where a tailings pond is used, it is usually located at the stream's edge, and wastes to the stream include leachings from the tailings pond as well as certain direct discharges such as process wash waters.

"Previous Studies. Prior to the 1955 field survey several small sets of samples were collected and analyzed. Eight river water samples collected from Colorado streams in October, 1950, by the Western Gulf and Colorado Basin Office of the Public Health Service, were shipped to the University of Rochester and there analyzed for dissolved radium by Hursh. (1) The results were as follows:

TABLE I

Water samples of October 1950

Location	River	Flow, cfs.	Soluble Radium, uuc/l	
			Above Mill	Below Mill
Durango	Animas	300	0.20	4.5
Naturita	San Miguel	64	0.13	16.9
Uravan	San Miguel	64	4.4	43.4
Rifle	Colorado	1600	0.36	4.5

Also quoting from the same report:

"The 1955 Field Survey. During the period September 22 through 30, streams in the vicinity of eight of the operating ore processing mills were visited for purposes of making a general sanitary and biological survey, and to collect samples for subsequent radioassay. The mill at Grants, New Mexico, was not visited. Two of the processing plants - those at Rifle and Durango, Colorado - were visited and the process observed.

"Stream sampling stations were generally located immediately above and at a selected point below each of the mills. At each such station grab

samples of water, river mud, and aquatic organisms were collected, except where circumstances prevented. Biological samples included both algae or other plant growth attached to rocks, where available, and bottom animals (developmental stages of caddis flies, stone flies, and mayflies, etc.).

"A general description of each of the streams surveyed, as of September, 1955, is as follows:

"Animas River near Durango, Colorado

About one-half mile above the uranium mill this stream was in good condition, about 3 to 4 feet deep, with coarse rubble and small boulders, scarce to moderate algae and bottom animals. At a location about a half mile below the ore processing plant the river appeared unchanged in character.

The waste products from the acid leach process were delivered to a tailings pond. Other mill wastes were discharged directly to the Animas."

Table II

Radioactivity of River Waters

River	Location	Radioactivity, uuc/l			
		Gross* Alpha	Gross* Beta	Soluble Radium	Soluble Uranium
Animas	Above Durango	2	32	0.2	0.3
Animas	Below Durango	34	26	3.3	8.0
Colorado	Above Rifle	0	7	0.4	n.d.
Colorado	Below Rifle	49	15	0.4	n.d.
Colorado	Above Grand Junction	13	22	0.3	n.d.
Colorado	Below Grand Junction	183	295	39	n.d.
San Miguel	Above Naturita	10	16	0.3	2.8
San Miguel	Below Naturita	148	61	9.4	24
San Miguel	Above Uravan	92	46	4.9	21
San Miguel	Below Uravan (1)	4,700	5,490	86	n.d.
San Juan	Above Shiprock (2)	220	369	0.2	n.d.
San Juan	Below Shiprock (2)	170	204	0.3	n.d.
Jordan	Above Mill	5	28	0.4	n.d.
Jordan	Below Mill	23	51	n.d.	n.d.
Creek	Above Monticello	33	67	0.3	n.d.

* Total of suspended and dissolved fractions

** Minima

(1) Alpha activity about 50 percent dissolved; beta activity about 12 percent dissolved.

(2) Suspended solids very high (3150 and 4400 PPM); most of gross alpha and beta activity in suspended form.

Table III

Quality of Mill Effluents

River	Location	Radioactivity, uuc/l. Gross* Alpha	Gross* Beta	Soluble Radium	Soluble Vanadium mg/l.
Animas	Durango, tailings pond effluent	3,220 (2)	7,510 (2)	25	13.5
Animas	Durango, direct effluent	43,200	16,300 (2)	76	62
Colorado	Rifle	1,150	1,100	4.5	1.5
Colorado	Grand Junction	6,930 (2)	9,210 (2)	920	3.7
San Miguel	Naturita	710	590	5.4	4.3
San Miguel	Uravan	244,000 (1)	305,000 (1)	83	6.9
Jordan	Salt Lake City	72	140	5.5	1.4
Creek	Monticello	33,700 (2)	31,400 (2)	81	355

* Total of suspended and dissolved fractions.
(1) Virgually all suspended activity.
(2) Mainly dissolved activity.

"In this connection, it is also worthy of note that in its proposed rules (8) the Atomic Energy Commission suggests a maximum permissible average concentration (nonoccupational) of radium in water of 4.0 uuc/l.

"Soluble uranium at polluted locations was of no consequence, since the MPC for natural uranium based on its chemical toxicity, is 70,000 uuc/l."

Further work was done in 1956 and is reported in "Effects of Uranium Ore Refining Wastes on Receiving Waters", by Tsivoglou, Bartsch, Rushing, and Holaday, presented at the 4th Nuclear Emergency and Science Conference, March 17-21, 1958; but this work did not include sampling of the Animas River.

Quoting the above report, Page 3, "The maximum permissible concentration in a domestic water supply is 40 micromicrograms per liter." This permissible water concentration refers to soluble radium, and Handbook 52 further advises that a safety factor of 10 be used with the above figures.

At present, work is in progress in cooperation with State and U. S. agencies, but all the results are not available at this time.

On the basis of present operation the following is the maximum volume of liquids discharged into Animas River:

Direct discharge	125 gals per minute
Tailings Pond Discharge	175 gals per minute
Total	300 gals per minute

The average flow in the Animas River at Durango is:

1,130 cu. ft. per second
507,178 gals per minute

The average dilution then becomes: 507,178 to 300
1,691 to 1

On April 17, 1958, the company took the following samples at regular intervals over a 24-hour period:

#1 Animas River above mill
#2 Animas River at Sunnyside Bridge about 10 miles below mill
#3 Direct discharge into river
#4 Tailings pond discharge into river

Samples #1 and #2 were sent to Department of Public Health, State of Colorado, for analysis in addition to company analysis.

Animas River Flow at Durango, April 17, 1958:

800 cu. ft. second
359,064 gals. per minute
Dilution rate 359,064 to 300
Dilution rate 1,197 to 1

Lightner Creek enters the Animas River below flow measuring point so Sample #2 below mill has the lightner Creek volume in addition to measured flow. Also, the City of Durango sewage plant discharge enters river below the mill and above #2 sample point.

The above samples were analyzed in the company laboratory with the following results:

	pH	V_2O_5	U_3O_8	SO_4	Cl
#1 River above	7.60	nil	trace	.0741	.0139
#2 River below	7.95	.0002	.0004	.0801	.0114
#3 Direct discharge	8.75	.1630	.0520	21.81	8.70
#4 Tailings pond discharge	2.30	.251	.0880	5.48	1.10
#5 Composite #3 and #4	4.10	.214	.0730	12.28	4.26

All of the above results are in grams per liter. To convert to parts per million multiply by 1000.

Although the vanadium content in the river checks closely with the calculated content from addition and dilution, the chloride content is less down river than up river.

The analysis has been checked and this difference indicates an unbalance in some of the soluble contents of the river water.

We wish to add in closing this statement that the Vanadium Corporation will work with the various agencies on this matter and will consider any suggestions given for their possible application to the problem.

Supplemental Report: Recent radiation studies made by Vanadium Corporation of America in connection with Colorado Health Service on the Animas River:

Date	Location	Flow cfs.	Effluent to River Flow Ratio	Soluble Radium uuc/l Above Mill	Below Mill
3/24/58	Animas	400	1-600	5.0	6.0
4/17/58	Animas	800	1-1197	2.4	5.0

The above analysis was made by Colorado Health Service at their laboratories under the direct supervision of Mr. Jack Torrey.

That is our statement.

MR. STEIN: Thank you, Mr. Maxwell. I would like to suggest that we put your statement on the record at this point.

Are there any questions from Colorado?

MR. GAHR: Is that information available to any of us?

MR. MAXWELL: That is Company confidence.

MR. STEIN: Are there any further questions? - New Mexico?

MR. CALDWELL: I have one question. We made a joint inspection of the mill. At that time it was our understanding that the tailings pond area is limited. Is there any planning on the part of the company in terms of new storage at this mill site? The plans, as I understand it, call for a considerable increase in production, or at least more than has been the case in the past.

MR. MAXWELL: That is right.

MR. CALDWELL: Thanks.

MR. STEIN: Are there any further questions from New Mexico?

In reference to the question Doctor Leland brought up before -- do you care to comment on the statement that we have heard that the Naturita plant will be closed?

MR. MAXWELL: We have closed the Naturita plant on September 1 of last year. We will expand our Durango operation from 450 tons per day to 700 or 750. We have recently doubled the size of our tailings pond and have secured sixty additional acres downstream for tailings disposal. I think we are adequate in that respect.

MR. STEIN: May I ask one more question? As I read the AEC license, you can expand that operation and still be covered by that license?

DOCTOR WALKER: The license as issued by the Commission, states uranium processing - without limitation as to quantity.

MR. REYNOLDS. S. E. Reynolds, New Mexico State Engineer. I wonder if you made computations of the dilution ratio at minimum flows?

MR. MAXWELL: I have not. No.

MR. REYNOLDS: Would you know what the minimum flow is?

MR. MAXWELL: I might ask Mr. Brinker.

MR. BRINKER: The minimum flow in the winter is around 200 cfs, as compared with the April figure that we have in the statement of 800 cfs.

MR. REYNOLDS: Would you know the minimum flow in August?

MR. BRINKER: No, I don't.

MR. STEIN: Mr. Reynolds, I would like to thank you for your contribution.

DOCTOR TSIVOGLOU: About stream gauging stations, -- records for Durango, Cedar Hill, New Mexico and Farmington, New Mexico show minimum daily flows at these stations have been recorded at 94, 90, and 5.4 cfs., respectively.

MR. STEIN: I might indicate for the folks in the audience who might not be familiar with the water pollution control problems, that this water pollution control is somewhat similar to a utility, such as a telephone utility or an electric utility. In an electric utility they build for peak loads. If you can just reverse that, water pollution control is designed for minimum low flows because, generally speaking, when there is a minimum amount of water for dilution in the stream that is where you get critical conditions. The engineers have made long surveys and checks. Obviously they do not design for minimum flows for a stream which might occur every fifty or one hundred years. We could anticipate a minimum flow for a certain period of time, for perhaps each five years, the criteria may be designed for the critical periods.

Thank you, Mr. Maxwell.

Are there any further questions?

MR. GAHR: Mr. Chairman, we have in the audience Mr. W. L. Bruce, Secretary-Treasurer of the Animas River Water Users, of Durango. Prior to his coming forward, I would like to present the Chairman with some photographs, together with his prepared statement.

MR. STEIN: If there is no objection from the conferees we will put them, for the record, in the files in Washington.

MR. BRUCE: W. L. Bruce, Secretary of the Animas River Water Users Association.

I might say that we are in the position of a stepchild in the water pollution problem. This organization was started in 1951, but after discussions of the pollution of the river at the meetings of the Animas River Grange 194, situated at Hermosa, Colorado, the Grange masters appointed a committee to work on pollution problems. In our investigation and compiling of data, we consulted some attorneys about what action we should take, and they advised us to incorporate as an organization to handle this situation.

The Animas River Water Users, Inc., sponsored by Animas Valley Grange 194, was organized August 15, 1952, for the purpose of preventing the Silverton

mines from dumping mine tailings into the Animas River and also for stopping the use of Animas River for sewerage and garbage disposal, so that Animas Valley residents could have clean water for irrigation and domestic purposes.

In addition to the benefits of Animas Valley residents having clean water for domestic use from the Animas River, it is our desire to make the River an asset to Durango and the San Juan Basin, as an attraction for sportsmen and tourists, for fishing and outdoor mountain recreation.

In our investigation of Animas River sources of pollution, this is what we found:

On account of the small amount of mining around Silverton for several years, there has been very little pollution from mine tailings. But for the past 35 or 40 years, the Town of Silverton has been using a flat piece of ground on the bank of the Animas River as a city dump, and the raw sewerage from the town has been emptying into South Mineral Creek since the sewer system was installed. South Mineral Creek connects with the Animas River a short distance from where the mouth of the sewer is.

Every conceivable kind of garbage has been found in the city dump from household refuse to carcasses of dogs, cats, deer, elk and butcher shop, hotel and restaurant meat scraps. The city takes a bulldozer and pushes this garbage to the bank and into the Animas River to be washed away and finally destroyed by decomposition. The same condition exists at Durango as regards sewerage disposal. It is common practice for all residents and businesses along the Animas River at Durango to dump their garbage and refuse into the river -- which our pictures will substantiate.

There are six outlets of open sewer emptying into the Animas River and the present Imhoff tanks are so heavily loaded that practically raw sewerage goes through them and into the Animas River.

Refuse from the Vanadium Plant at Durango is being dumped into the River. This has been a bitter contention of sportsmen in that it pollutes the stream and is injurious to fish in the river which river has for years been attractive to fishermen and tourists in Durango.

We are presenting pictures to substantiate our contention of Animas River stream pollution by the accumulation and dumping of garbage and sewerage along the banks and into the river at Silverton and Durango and residents between these towns using the river for a garbage dump ground.

The town of Durango is now in the process of putting in adequate sewerage plant to handle all city sewerage and stop it from going into the river.

We have had a number of meetings with Silverton City officials in an effort to have the garbage kept out of the river and a treating plant for sewerage.

On July 16, 1954, a delegation of fourteen Animas Valley residents had lunch with the Mayor and some of the City Councilmen. The garbage and the sewerage was thoroughly discussed. It was promised that the garbage would be bulldozed back from the river and a new dump ground would be found; but that the

town was so badly in debt that it would be impossible to finance a sewerage treating plant. Later inspection showed that the garbage had been pushed back from the river. But on October 31, 1955, two residents of the Animas Valley, with their families, were in Silverton and on examination of the dump, they found a Silverton city employee pushing all the garbage up to the bank and into the river.

They contacted the Mayor and on inquiry as to why this was being done, were told that the town had been informed by La Plata County Health Unit that the garbage would not contaminate the water and make it unsafe for domestic use.

From that time on we have not been able to get any satisfactory solution of the stream pollution at Silverton. We have not been able to get any help from the State or San Juan Basin Health Units in our efforts to stop pollution of the Animas River.

Quoting from a letter from Dr. Cleere dated July 13, 1954, "Regarding the situation at Silverton -- There is ample water available for dilution of sewerage at Silverton". And the distance to places of domestic consumption would tend to purify the water and not create a health menace.

After checking the carcasses from the dump that are bulldozed into the river and the sewerage that comes from the sewer outlet, it is our contention that the animal carcasses do not disintegrate very quickly. Every time you take a drink of water, the thought comes up that you may be drinking somebodys unborn child.

The financial situation in Silverton has changed. All mining property which was not paying taxes has been sold and this is now back on the tax rolls, and the Town of Silverton and San Juan County are now in good financial condition and there is no reason why they should not be forced to provide healthful sewerage and garbage disposal.

We think discrimination is being shown by both the State and local Health Units. If an individual in the community builds a home and installs sewerage, he is not allowed to have his disposal field closer than fifty (50) feet to an irrigation ditch or stream. His plumbing is inspected and the installation must comply with State Health specification, which is fine. But we do not see where a town, community or an industry should not have the same treatment in sewerage or garbage disposal. -- Respectfully submitted, E. R. DeLuche, President, Animas River Water Users Association.

Now, I have two letters from residents of Durango that I would like to incorporate in this report. One is from Ross D. McCausland, owner of the "Ah Wilderness Guest Ranch, Inc." on the Animas River 23 miles north of Durango.

"Trout fishing in the Animas River between Rockwood and Elk Park, a distance of about 21 miles is usually very good. Occasionally very stagnant water is pumped into the river out of mine shafts in the Silverton area as well as mill tailings. This makes the water so murky and highly acid that the fish do not bite and of course fly fishing is out of the question. In the past four years this condition has occurred on the average of four to five times during the summer. Previous to that time when the mines and mills in Silverton were more active the condition would exist for several weeks at a time.

"The Animas River to the south of Durango appears to be excellent water for trout fishing. However, this appearance is deceiving. There is a terrible stench from the putrid water and a thick slime covers the entire floor of the river for at least ten miles below Durango. Besides this repugnant condition of the water and the river bed one who is persistant in trying out the fishing will likely have the water turn murkey in just a few minutes from waste material dumped into the river from the V.C.A. ore processing plant at the south end of Durango. This section of the river could be a very attractive fishing spot for local people and tourists but it is not because of the condition described above. It is apparent that much sewage goes directly into the river both above Durango and within the city limits. A great many trash and garbage dumps are seen along the banks where high water partly washes them downstream.

"The city dump at Silverton is pushed into the Animas River as it is a convenient means of disposing of the city refuse. All along the river one sees tires, cans, discarded clothing and other refuse that has washed downstream from this Silverton dump. Also one can observe the direct entrance of the city sewage system into the Animas River about a half mile below Silverton.

"The Animas River has many miles of open water that would provide excellent fishing for the sportsmen but the above conditions take away most all the appeal and kill a great many of the fish in the river." -- Ross D. McCausland, Owner and Manager of "Ah Wilderness Guest Ranch, Inc.," on the Animas River 23 miles north of Durango.

I also have another letter from a citizen of Durango, as to a condition that happened on the 5th of April --

"This is to certify that on April 5, 1958, Roy Magganell, 1015 Grand Ave., Albuquerque, New Mexico, John J. Cobb, and myself (Elvin T. Cobb), 1061 Fifth Ave., Durango, Colorado, were fishing from the railroad bridge crossing the Animas River to the Stockyards opposite the VCA smelter. At about 9:30 o'clock A.M. a stream of red, brackish water began to pour forth from the smelter which gave the stream a color similar to what we have during our high water period. I might add that this was not an isolated instance when the stream is discolored from water from the smelter, as I have seen the same condition time and again while hunting ducks downstream from the smelter.

"I have driven over one of the two highway bridges upstream from the smelter and when crossing the bridge noted how clear it was. At times one can see fish in the water. Then I have driven on the same day across the bridge in Mexican flats downstream from the smelter to find the water muddy from tailings from the V.C.A. smelter.

"I have hunted and fished the Animas from Bondad to Durango and scattered along the banks of the stream are metal drums which have been pushed over the dump at the smelter and have been scattered downstream by the high water.

"It is my observation that the condition has become progressively worse during the past five years. Some five years ago very fine fly fishing was possible downstream from Durango. Today fly fishing downstream from Durango is practically nil. In fact all the fish were killed for a distance of five miles downstream from Durango about two years ago by acid which was dumped into the river because of an accident at the smelter. The Fish and Game Department reported the fish killed.

"Nor is the V.C.A. smelter the only polluter in Durango. It is my understanding that garages do not have traps to catch their oil, etc., and this is drained into the river at times. It is my understanding that traps should be used to catch the refuse in such places as garages.

"The City of Durango has only partial sewerage disposal. At most they only take out the solids. I believe there is one or two sewers that dump raw sewerage into the stream.

"My interest in this is that of a fisherman, hunter, citizen and taxpayer in this community. I'm willing to pay more taxes to take care of the sewerage.

"As time goes on we are going to produce more and more vegetables to the south of Durango. It is my contention that water that is contaminated and is used to irrigate vegetables can be a source of spreading disease through the vegetables.

"To my way of thinking water is the greatest resource we have here in the West. We cannot afford to waste the utility of water by allowing it to be polluted." - Respectfully submitted, Elvin T. Cobb, 1061 Fifth Ave., Durango, Colorado.

That shows a picture of garbage scattered over the area at the Silverton dump grounds, later on to be pushed into the river.

That shows a picture of the garbage as it was bulldozed up to the river at Silverton.

We have another picture taken by a technician of the Colorado Fish and Game Department, showing the carcasses of two dead animals, and showing portions of two carcasses partially consumed by fire.

(PICTURES ENTERED AS "EXHIBIT B")

Our President took a lot of slides that we had hoped to show at this meeting. We have a projector and a lot of slides showing the contents of the garbage and sewage and the conditions along the bank at Durango; also different points of pollution we had hoped to bring up at this meeting.

MR. STEIN: Thank you, Mr. Bruce. I should like to emphasize, before we throw this open, that the jurisdiction of the Public Health Service only relates to the affects of the pollution in New Mexico. We have no jurisdiction over intra-state pollution as far as enforcement is concerned. Our role there is to provide technical aid and assistance to the States.

Do we have any questions from New Mexico?

DOCTOR LELAND: A question I will bring up later -- I very much appreciate the statement by the gentleman, which presents an interesting situation which is also of concern to New Mexico, in addition to the radiation situation which we have been discussing this morning -- I respectfully refer the situation to Doctor Cleere.

DOCTOR CLEERE: Thank you. It is also nice to have Mr. Gahr, our Chief Sanitary Engineer, to whom I refer the matter.

Animas River Conference,

First Session

April 29, 1958

Exhibit "B" is retained in the files of the Public Health Service, Water Supply and Water Pollution Control Program, Interstate Enforcement Section, Washington, D. C.

MR. GAHR: Mr. Bruce, you refer to a letter dated July, 1954, and I believe that you merely extracted portions from the letter.

MR. BRUCE: I have the letter here if you care to refer to the whole letter.

MR. GAHR: I would like to have the complete letter for the record.

MR. STEIN: This seems to be an intra-state situation rather than inter-state. The Public Health Service only has jurisdiction over inter-state problems. Would you like to have the entire letter read?

MR. GAHR: In the interest of saving time, Doctor Cleere, and myself both agree we can dispense with it.

MR. STEIN: I do not know that we need the enclosed correspondence. However, about the last that you have written -- would you like to see that phase, Mr. Gahr?

MR. GAHR: Yes -- It is quite a long one isn't it?

MR. BRUCE: I made the statement there about us being a step-child -- We kind of accidentally received the news that there was going to be this meeting here, and while we were not in very good graces with some people around Durango, there are those who appreciate what we are doing and are supporting us financially.

MR. STEIN: For the purpose of the record, do you have a copy of your letter of July 13, 1954?

MR. GAHR: Yes. I would like to have the entire letter entered in the record.

MR. STEIN: Are there any further questions or comments?

DOCTOR CLEERE: I think Mr. Bruce should be commended for his interest in the problem.

MR. STEIN: Thank you for coming.

MR. BRUCE: We appreciate your kindness in allowing me to present my statement.

(LETTER ENTERED AS "EXHIBIT C")

MR. STEIN: Do you have any other participants from New Mexico?

MR. CALDWELL: One thing we are interested in -- these pictures were taken in 1955?

MR. BRUCE: Some in 1955 and some in 1956. These pictures, these slides - if you want to see them, were taken just last year.

MR. CALDWELL: Inasmuch as these exhibits would have a bearing on our initial proposal, could we see them this afternoon?

46 a

"EXHIBIT C"

STATE OF COLORADO
DEPARTMENT OF PUBLIC HEALTH
State Office Building
Denver 2

July 13, 1954

Mr. W. L. Bruce
Secretary-Treasurer
Animas River Water Users, Inc.
R.F.D. No. 1, Box 65½
Durango, Colorado

Dear Mr. Bruce:

Thank you for your interest in the water pollution control problem as it effects the Animas Valley residents as well as those farther downstream in New Mexico. I can assure you the State Health Department also wants progress in pollution abatement. However, there are times when another need is more pressing.

I should like to point out that there is a very great need for the people of Durango to have a safe and adequate public water supply system. Our concern of the need for a safe public water supply system was expressed by the extent to which the State Health Department has gone to convince the city officials at Durango that such a need was highly important. We also learned from the Durango officials that they have great problems of financing which make it necessary for them to proceed, as in this case, with one project at a time. Because Durango now has two Imhoff tanks and four septic tanks through which their sewage is passed, it seemed reasonable that the greatest emphasis should be placed on securing a safe water supply, not only for the people of Durango but for the countless hundreds of sportsmen and tourists who come to that city during each year. Please understand that we do favor a modern sewage treatment plant for Durango, the same as for many of our Colorado cities, but I think you will agree that of the two items, the need for a safe public water supply is far more pressing and should be provided first.

Relative to the sewage problem at Silverton, it is agreed that domestic sewage should receive at least primary treatment. However, the City of Silverton points out its sewage is diluted by large quantities of water. Upstream from Silverton at Howardsville the lowest recorded flow in 1943, which occurred in March, was 13 cubic feet per second. At the same place during 1944 the lowest flows occurred during January and March and were 15 cubic feet per second. The water from Mineral Creek is also available for dilution. I think this gives you both sides to the sewage problem at Silverton.

As to the complaint made by the people residing on the Florida River watershed, these have been investigated by the San Juan Basin Health Department and they found no evidence of untreated sewage being discharged to the stream. However, evidence of contamination by wild life, sportsmen, livestock, soil erosion and picnickers was found. Such pollution is a normal thing and it is very doubtful if it can ever be prevented unless the water shed is completely cleared of livestock and denied to all people except caretakers of the watershed.

Again let me say that I greatly appreciate your interest in giving consideration to the problem of pollution control. Your interest is very valuable because in the last analysis it will take many people, working together, to get our water courses cleared of pollution where it exists in dangerous amounts.

Sincerely yours,

(Signed, R. L. Cleere, M. D.)

R.L. Cleere, M. D., M.P.H.
Executive Director

RLC-WNG:gas

46 c

"EXHIBIT C" - 3

R.F.D. No. 1, Box 65½
Durango, Colorado
June 12th, 1954

Dr. Roy L. Cleere, Director
State Health Department
Capital Annex
Denver, Colorado

Dear Sir:

I attended the public meeting between you and the members of the City Council at Durango. After listening to the discussions of the agreements that were made and hearing Mr. McGlone promise the city council that if the agreements were complied with that the City of Durango would not be bothered for a long time about any improvement to the present sewerage system by the State Health Board.

It appears that the residents of Durango are going to get about everything they voted against but will still have the privilege of dumping raw sewerage into the Animas River indefinitely.

So Durango sportsmen will continue to have sewerage fattened fish and there is not enough people using Animas River water for domestic purposes between Durango and the New Mexico line to create any political problem and what is found below the state line will be the problem of our neighbors in New Mexico. We are not too much concerned about conditions of the Animas River south of Durango only to help everyone get clean water.

Animas Valley residents who use river water for irrigation and domestic purposes are concerned about pollution and contamination of the river and irrigation ditches north of Durango. It is also their desire to help keep the river clean as a sportsman and tourist fishing attraction.

At the present time there is some half a dozen places in Durango that raw sewerage is going directly into the Animas River and at times it is reported the disposal plant is overtaxed and untreated sewerage goes through it.

Silverton has already dumped their sewerage into South Mineral Creek, about 500 yards from the Animas River and for years have used a flat piece of ground along the Animas River bank for a city dump ground for garbage, manure and city trash. What will is burned, balance is shoved into the river with a bulldozer.

Residents of the Florida River have complained to our organization of places of pollution and contamination on that river.

The Animas River Water Users Inc., sponsored by the Animas Valley Grange 194, was formed for the purpose of getting clean water for ourselves and to help the community keep the streams clean of mine tailings and sewerage pollution as a tourist fishing and recreation attraction.

There is some confusion on the interpretation of the present laws governing stream pollution and contamination. The interpretation seems to be in favor of the big corporation and those with political pull.

I was instructed by the directors of the Water Users, Inc., to write you to see if other known points of pollution and contamination would be accorded the same consideration as that given Durango by the Health Department.

An early reply will be appreciated.

Yours truly,

(Signed, W. L. Bruce)

MR. STEIN: Let me point out that for the purpose of the record, introduction of slides is one of the most difficult things -- they just do not help. We have two areas of concern here. One, is the possible problem of radiological material; and, two, a composite of municipal and other wastes such as refuse dumps being put into the river, domestic sewage wastes of a liquid nature, and possible leaching wastes from mining operations in abandoned mines. We may have to come up with some recommendations for solutions as the proposed study progresses. The Colorado people might come forth with a pretty complete report on some of these areas under consideration, so we can make a determination of what progress is being made in these areas and what we can do to help correct them. I have no objections to the slides if the folks here want to look at them, but we must recognize that slides do not show in the record.

MR. BRUCE: We realize that we made a mistake in presenting the slides; but the President of our organization took these pictures as evidence of the contamination discussed.

MR. STEIN: Thank you very much.

DOCTOR LELAND: Do you want to break for lunch?

MR. STEIN: If there is no other material from New Mexico, I think we can complete this within the next ten or fifteen minutes. I do not know who else you might want to have participate on the New Mexico side. Do you want to call on other participants?

MR. CALDWELL: We have several others -

MR. STEIN: Let's break for lunch. It is now 12:30. Would it be possible to be back in an hour - hour and fifteen minutes? How long does it take here --?

DOCTOR LELAND: Sometimes it is slow and sometimes it is fast --

MR. STEIN: Let's adjourn and try to be back by 1:30.

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MR. STEIN: May we reconvene? Before we call on New Mexico, I think AEC may have one additional statement to make. We will call on the AEC Representative, Mr. Robert F. Barker, Division of Licensing and Regulation.

MR. BARKER: Barker, Atomic Energy Commission, Washington, D. C. Division of Licensing and Regulation.

I would like to add one phase of the licensing program which was not mentioned earlier. The operations of the mills for recovery of vanadium has been a continuing process for several years. Early radium recovery was instituted; uranium was a fairly recent development in this processing of rare earths. The recovery was instituted by the government primarily. As such, this was not subject to the same types of controls as those items covered in vanadium recovery mills. At the same time there was money being supplied in development of the uranium recovery program. Several research programs were subsidized for development of uranium fields and discovery of uranium ores.

This was part of the program. The licenses which were issued for uranium processing -- most of them were issued in 1946. At that time there were no legal limits established. As a matter of fact, the legal limits were instituted, or were actually made effective only as of March 1, 1957. This is the Part 20 Standards for Protection Against Radiation which was referred to earlier.

Therefore, this is one explanation for the apparent lack of activity, on the part of the AEC, to see that these regulations were being complied with. There were no effective federal regulations prior to March of 1957. I did want to add that, in particular the survey which was made last year, we found the mills very cooperative in research-type surveys, where we were interested in spot samples; and at the same time we have from Mr. Walker a statement that the mills have been very cooperative in the inspection effort. It is anticipated that there will be no problems with regard to our conferences by correspondence, the compliance effort which the Division of Licensing and Regulation makes.

I wanted to emphasize, contrary to impressions that might have been given in the earlier statements, our AEC Operations are not of the clobbering type of operation, they are of the cooperative program type. We do have regulations which must be met. To do this, we will offer every assistance that we can, within our own limitations; we will cooperate with the mills in achieving compliance; we will not, in a sense, move in with the idea of trying to put them out of business because that in turn would put us out of business.

MR. STEIN: Thank you, Mr. Barker. Now we will call on New Mexico. Do you have any other participants you would like to call on now?

DOCTOR LELAND: We have quite a number. Mr. Caldwell will introduce each person.

MR. CALDWELL: We would like to ask Doctor Warren Rasmussen, District Health Officer, San Juan County Health Department, with headquarters in Aztec. We would like to ask Doctor Rasmussen if he has anything he would like to add.

MR. STEIN: May I ask the participants from now on, if we are going to complete this afternoon, to try to confine their remarks to about five minutes. If they have any other additional material, we will be happy to put that in the record and give that full consideration. Doctor Rasmussen --

DOCTOR RASMUSSEN: I do not have a formal statement, but I would like to express the grave concern that we have in our area, concerning interstate stream pollution. Not only is it our official responsibility, but we are also the ones living up there who are ingesting these pollutants. We of course have been concerned about the sewage pollution in the Animas River and the San Juan River, because we have probably two or three thousand people who are drinking raw river water. We are not proud of it.

However, our attention was focused on the problem of industrial waste pollution last summer. We received several calls from sportsmen, stating that on two different occasions there was a marked turbidity and discoloration in the Animas River. On one occasion a local clergyman, who is also a sportsman, followed the river back up to its source and found it to be at the Vanadium Corporation Plant in Durango.

There is a new school of thought among the anglers; some of them would like to have some radiation pollution so that the fish will develop two heads, and they will stand a better chance of biting, they say --(Laughter). We are concerned about this and we are trying to minimize the public reaction to is. Needless to say we do not want to start a panic up there. We had a panic last year when an acid truck overturned in the Animas River. People as far down the river as seventy-five miles were getting all sorts of mysterious symptoms. We have had as recently as last week, a physician who happens to be the Chief of Staff of the San Juan Hospital, asked us what we were going to do as the Health Department, about the possibility of radiation pollution of the Animas River. We are, therefore, concerned about it.

We were happy that we could assure him that there was going to be a conference this week, and things are starting to move. I would like to suggest this possibility; that if there is a survey made in that area, there has been concern expressed about the possibility of underground pollution of the San Juan River from the plant in Shiprock. It might seem a simple matter to include that area in whatever survey is made.

I would like to state that we in that County Health Department, are interested in cooperating in any way we can, with our facilities and with our staff. We are already starting to collect samples, and I can say we are eager to go.

MR. STEIN: Are there any questions from Colorado?

MR. GAHR: None --

MR. STEIN: Are there any from New Mexico?

MR. CALDWELL: The next man we would like to call on is Mr. Warren Griffin, who is the Chief Sanitarian of the San Juan County Health Department.

MR. STEIN: Mr. Griffin.

MR. GRIFFIN: I do not have any formal type statement to make, but as Doctor Rasmussen says, we are vitally interested and we will cooperate with anyone, anywhere, in straightening out the problem. We will make our personnel and our facilities fully available.

MR. CALDWELL: The next person we would like to call on is Mr. Robert Morfitt, who is with the Indian Health Facilities, Public Health Service.

MR. MORFITT: Thank you, Mr. Caldwell, and Mr. Chairman.

Mr. Caldwell, earlier in his presentation, mentioned some of the downstream users on the San Juan. We realize you are mainly concerned with the Animas River, but we would like to point out some of the interests immediately downstream from the Animas River as it enters the San Juan River. Commencing at the edge of this map right where it is cut off (referring to map), and running some twenty-five miles downstream, are a number of Indian families. This is about the edge of one portion of the Navajo Reservation. Within this area there are probably some 3,000 Navajos living along the river on some of the irrigation projects. These people make considerable use of the river for domestic water uses, for irrigation, for recreation, and stock watering.

I thought it might be of some interest on the special problems of the Navajo, there may be some need from the people living in the Animas River Basin, in that the Navajo utilizes for food only that which he can raise and produce within the irrigated area or on that range immediately adjoining the river. So that if there is a problem of concentration in the meat sources, or in green vegetables, the Navajo family in this area has as a meat source the sheep that are grazed on the irrigated land and watered in the river or in the irrigation ditches.

In addition, as Doctor Rasmussen says, we don't like to admit it, but many of these people drink raw water directly from the irrigation ditches or from the river. Whatever vegetables or green crops are those that are raised in the valley on irrigated land. These people may present somewhat of a unique problem in that all of their food crops are raised basically in this valley. They are not supplementing their meat from cattle raised in Colorado or hogs raised in Kansas; they are not importing green or fresh vegetables; so that whatever vegetables they use are local products. If this is a problem, we would like the conferees to take into consideration whether or not additional studies might be of value on some of the Navajo lands.

In addition to the 3,000 people who live in the immediate area, there are several domestic sources taken from the river, such as BIA installations at Shiprock which at present are using approximately one-half million gallons of water per day, and two or three schools in that region immediately below Farmington utilizing approximately another one-half million gallons per day.

I believe that is all I have, Mr. Chairman.

MR. STEIN: Thank you. Do we have any questions from Colorado?

MR. GAHR: No question, just a comment. I am in complete sympathy with what Bob has said, but would like to point out that the primary purpose of this study in the area under consideration, and if the funds are sufficient to do that, well and good; otherwise, I think we should keep in mind that everything should be concentrated on that particular area --

DOCTOR LELAND: I would like to comment, I speak also for Colorado; both Health Departments are completely collaborating with Indian Health in

facilitating this particular study, and we will do our best to keep you informed, as if you were one of our own. (Laughter)

MR. STEIN: Thank you.

MR. CALDWELL: We would now like to call on Mr. Lester Blaschke, Chief Sanitary Engineer with the Indian Health Facilities in Albuquerque.

MR. BLASCHKE: I have nothing to add. Mr. Morfitt has presented the interest and concern of our office regarding this matter under discussion.

MR. CALDWELL: Thank you, Mr. Blaschke. We invited some of our neighboring states to be represented, and Mr. George Marx, State Sanitary Engineer of Arizona is here.

MR. MARX: First I would like to say I appreciate that invitation very much. I have really learned a lot. We in the Lower Colorado River Basin are happy to learn that the Upper Colorado River Basin is instituting a program of cleaning up the Upper Colorado River in order to maintain the quality of the water in the Lower Colorado River. At least we are getting a start. (Laughter) As you know, there is a dam going in Glen Canyon which will be a good catch basin to catch those gross solids that were spoken about this morning. That will practically stop them at the Utah line. But seriously, we are interested in these alleged radioactive wastes as they may affect the quality of the water down below. We have many irrigation projects and domestic water supplies in the Lower Colorado River Basin.

That is about the extent of my comments, Charlie.

MR. CALDWELL: Thank you, George. We asked a representative from Utah to be here, and we have Mr. Calvin K. Sudwicks --

MR. SUDWICKS: I would like to thank you for the invitation also. I am here representing the Utah Water Pollution Control Board, and I am just an observer. Thank you very much.

MR. CALDWELL: We also have invited a representative of the New Mexico Game and Fish Department, Mr. R. L. Brashears.

MR. BRASHEARS: Outside of expressing concern over the pollution of any of our waters, I do not have a statement to make. Thanks.

MR. CALDWELL: Mr. Steve Reynolds was here --, Mr. Spiegel do you care to add anything for the State Engineer's Office?

MR. SPIEGEL: No.

MR. CALDWELL: Are there any of the towns, Farmington or Aztec, or any of the people from San Juan County who have not spoken? Are there any of those people here?

We would like to ask Mr. Robert P. Lowe, Chief of the Water Pollution Control Branch of the New Mexico Health Department, if he has anything he wishes to add to this discussion.

MR. LOWE: I have a couple of points I would like to bring out. First, Mr. Morfitt has stated that there are perhaps two or three thousand Indians downstream from the Farmington area, who use that surface water in various ways, probably mostly for domestic purposes. I would like to bring out the point that in this area, one of the things that makes it serious in regard to pollution of any sort, is the fact that there is a very poor quality of groundwater. It is not obtainable in most of the entire area; they have to depend on surface water. That is one of the reasons that we are concerned about the pollution of the Animas and in turn the San Juan River, where they come together on the edge of that map down here at the bottom. Also, I think it has been brought out by Mr. Caldwell and by Mr. Krause; first on the ultimate development of the San Juan River Basin. We have been approached, and there are plans on the development of the Animas River Basin that will drastically change the river flow. Now there have been figures mentioned this morning about the various dilution factors. Those will be non-existent, it will be drastically changed, there will not be dilution in the river below Durango that there is most of the time now.

We have reviewed preliminary reports on the development of the Animas River, which call for a diversion dam above Durango for diverting the river into La Plata River Basin for irrigational purposes. It will use all of the available water, except a small amount for fish life on the lower part of the Animas River and of course allowing for existing irrigation rights along the river below Durango and in New Mexico on the Animas River. That will change the picture quite a bit from what it is right now.

There has not been much mentioned in the way of chemical wastes in relation to the pollution of the Animas River, except by mining above, and of course there are chemical wastes being discharged from the mill process at Durango. I think those items should be considered in this overall survey. We of the State Health Department in the past assumed the AEC was attending to this problem, or had some control, and because of the nature of the National Defense Effort it was pretty well kept quiet. As you have mentioned, the AEC has just recently gone into surveying these mills, in December of 1957. In other words, it is quite a recent development on actually some action in this direction.

MR. STEIN: Do you have any questions or comments? (to Mr. Gahr)

MR. GAHR: No, I do not.

MR. CALDWELL: The next man we would like to ask if he would like to contribute, is Mr. Carl R. Jensen, who is our Supervisor of Occupational Health and Assistant Division Director of Environmental Sanitation Services.

MR. JENSEN: There is very little to contribute at this time. I have worked with the men in AEC and have enjoyed it a great deal. We have worked together on the isotope program, very little, just initiating our activities together on the mills. We have been in the mill work long before the first mill was built in New Mexico. Since our first experience with that, we have been working closely with every mill prior to construction to determine how they are going to dispose of their effluents - their wastes. Our main concern has been the contamination of underground waters. In this we have received extremely fine cooperation from the mill owners.

MR. CALDWELL: Thank you, Carl. The next man we would like to ask is Mr. John W. Hernandez, Associate Engineer, Water Pollution Control Section, New Mexico Health Department.

MR. HERNANDEZ: No comment, Charlie.

MR. CALDWELL: The last person we are going to call on, she has been a faithful attendant and we would like her to express any views she may have. Miss Robinson, do you have anything you would like to say?

MISS ROBINSON: I have no comments. I am only listening.

MR. CALDWELL: I think that concludes the list of people we have.

MR. STEIN: Thank you. I think the way this has developed, we can probably attempt, unless you want some discussions of the proposals, a combination summary and discussion point by point.

DOCTOR LELAND: We have persons here from the two Regions -- one of course is at the table, but also we have Mr. Alexander, Region VIII--

MR. STEIN: Oh yes, we would like to introduce first, Mr. Garth, Regional Engineer for Region VIII, Mr. Alexander of Region VIII, Mr. Fooks of Region VIII, and Mr. Schreeder of Region IX; also, Mr. Joe Anderson of the Dallas Office.

The reason all of you folks are here, as you can see, this is a relatively new procedure and it is evidently a problem common to all of the Regions in this area. Therefore, I think it will probably have considerable significance.

If we would attempt to summarize this and try to get agreement as we summarize, we can divide the problem into two kinds of pollutants:

(1) Radioactive wastes,

(2) Other types of wastes.

First, I think we can go back and examine the provisions of the Act. We can all agree from looking at the map --

MR. GAHR: Excuse me, Mr. Chairman. There is something that has been brought to my attention by Mr. Barnard, relative to comments made earlier on the matter of the San Juan below Farmington, and the whole problem that involves irrigation diversion of waters. Frankly, I am not at all well acquainted with this. Mr. Barnard is much better versed. For the record, I would like to say that the whole thing should be considered as an entity. There are diversions of many points, and I think this is what he had in mind.

MR. BARNARD: Barnard, Colorado. Before any question is raised concerning the potential effect of the Animas-La Plata project on dilution waters; if those are going to be considered, then I think all of the potential projects in the Upper Colorado Basin ought to be considered, including New Mexico San Juan-Chama Diversion and the Navajo Indian irrigation project which will represent a water use of something over twenty times the proposed Animas-

La Plata project. I make that statement in reference to the statement that it would increase the problem by virtue of the potential Animas-La Plata project which has not even been given a feasibility report as yet; unless also consideration is given with respect to the San Juan-Chama and Navajo Indian irrigation projects which are probably of much greater significance from the standpoint of dilution water below Farmington.

MR. STEIN: I think that point is well taken. Now, let me say that in any of these pollution cases, and just to clear this up and give a little background -- in any case involving pollution of interstate waters we necessarily devote ourselves to a rather narrow field, because in the past one of the problems in dealing with cleaning up pollution is that we have been too diffuse. We have had reports, for example, to mention others, on the Ohio River, the Mississippi River, on the Potomac River, and they are so big and involve so many factors that we just can't get at it, and nothing seems to be done over the years.

The technique we are trying to use in the administration of the Act, is to take a relatively small segment of the problem such as we have here, the pollution of the Animas River, and try to deal with that - just dealing with our problem. Now in the report, in any consideration necessarily the report will go over into other areas:

(1) We will get the diversions or proposed diversions, but they will just be part of background material.

(2) Possibly more immediate would be the question of the Indians down below. Obviously, that gets broader. Theory, of course, here is that if you would eliminate pollution, if that pollution existed, as it came into Aztec and Farmington, there would be very little likelihood that any of it would get down below to the Navajo Reservation. You would get that increment anyway.

That is the kind of theory we work on. Actually, we can find our efforts get very diluted if we begin to spread them out and explore all these problems to their ultimate conclusions. I am sure that Doctor Tsivoglou and all the rest of the folks working on the study, will take these things into account and put them in proper perspective. I think we will just have to evaluate if something has been given a feasibility report; or even if it has, how far away from fruition.

Now, to get back to summarizing; if we look at the statutory requirements, we have jurisdiction over pollution of interstate waters originating in one State affecting people in another State. I do not think there is any doubt that the situation described here today meets that requirement.

The next three points required to be covered by statutes:

(1) Occurrence of pollution of interstate waters subject to abatement under the Federal act,

(2) Adequacy of measures taken toward abatement of pollution, and

(3) Nature of delays, if any, encountered in the abatement of pollution.

Probably, from the material presented here today, we are too early to attempt to delineate with any specificity. We would have to wait perhaps another session of the conference to do that. Therefore, I would suggest, as I gather from the concensus of the conferees, that we consider this the first session of the conference, with other sessions to follow.

As pointed out before, it probably would be best to divide this problem into two areas:

(1) Pollution from industrial sources having radiological significance or radiation significance, and

(2) Wastes from other sources.

As I understand from the material presented today, the wastes from other sources are of various kinds:

(a) Wastes from refuse or garbage, or what we would call ordinary garbage disposal or a dump, which are alleged to be getting into the Animas River,

(b) The normal liquid and such incidental industrial wastes as we get from cities, going through city sewer systems. These may or may not be getting adequate treatment when they involve wastes from up around Durango and Silverton,

(c) Wastes from mining operations in that area, and probably wastes from abandoned mines.

I do not know that again we have enough specificity in that, but I think the outlines of the problem have been clearly indicated here.

What I would suggest is that Colorado prepare for the other conferees, by July 1, a report on the situation as it exists, as they find it, with reference to all of these aspects of the problem: (1) refuse, (2) domestic wastes from sewage, and (3) mining operations and abandoned mines; with possible recommendations for consideration by another session of the conference. This might include a specific recommendation with relation to Durango which may develop at that time, and perhaps a time schedule for Durango and these other folks to institute remedial measures, if such measures are indicated. That can be taken up by the conferees again when they reconvene. Very possibly a good many of these problems can be solved just in the getting of this report together for the conferees, by Colorado working with the people involved in the area.

The next point we have is the wastes due to the uranium milling operations in Colorado. The Public Health Service and Doctor Tsivoglou have made a suggestion as to a study that the Public Health Service has prepared and intends to embark on in the near future. As I understand this, the Public Health Service may start routine sampling almost immediately. However, the blueprint for the plan has been presented at this conference. If when we have had several suggestions made as to things which might be included; also the States of Colorado and New Mexico, and the AEC were invited to participate in this study; I think the precise and specific details obviously will have to be worked out.

At this point I would like to ask both States whether in principle they agree that it would be a good idea to cooperate and work together with joint State-Federal plans, along the outlines presented by Doctor Tsivoglou.

Is that agreeable to Colorado?

DOCTOR CLEERE: Yes.

MR. STEIN: How about New Mexico?

DOCTOR LELAND: It is agreeable to New Mexico; but here I should like to ask my Chief of Laboratory who is considerably interested in this subject, if he has any comments. Doctor Johnson, do you have anything to say?

DOCTOR JOHNSON: The Laboratory service is certainly interested in cooperating on this, and we will offer the full services of our facilities and our staff to assist with this program. Also, with the assistance of the Public Health Service and the Atomic Energy Commission in further development of this program.

MR. STEIN: I would recommend that as part of the summary, Doctor Tsivoglou take action to set up this technical study of the Animas River, and work out the details with the States concerned, and with the AEC to the extent that they wish to participate in the study; and that the detailed specifications be submitted to the conferees prior to the end of next month, which is by June 1. Hopefully, we will try to get the summary and a transcript out by then. That largely depends on the stenographic services, and this is a big job. It doesn't take very long to get those out once you have received them. I think that it is realistic to expect that we will probably have those sent back and duplicated in a month. It will be very helpful if we can in that package put in the detailed plans for the surveys.

This does not mean of course that routine sampling which is indicated should not be instituted before that, or immediately, if you think it is appropriate, or the folks developing the study think this is appropriate.

Next, I want to indicate that as soon as the folks engaged in the study can come up with positive recommendations, even though these be interim recommendations, that they forward these recommendations to the other conferees; if it is thought appropriate then the conference can be reconvened on the call of the Chairman to consider these.

Again, aside from a conference to reconsider such interim proposals, I think we should be in a position to come up with rather definite proposals in perhaps the concluding session of the conference, no later than one year from this date; and certainly as much before that as the study group can possibly give the conferees an indication that they have positive proposals, so that we can come up with relatively definitive conclusions and recommendations. Again, that conference will be upon the call of the Chairman.

Is there anything that any of the conferees, or anyone, wishes to suggest or add to the summary?

DOCTOR CLEERE: As a point of clarification, in your summation you have outlined a complete survey program of the Animas River with the State Health Departments of Colorado and New Mexico assuming the primary responsi-

bility for the study other than the portion of the study relative to radioactive wastes. I am trying to visualize the procedure of dove-tailing the studies, in other words. As I say, it would be well if we had someone to prepare a format for this complete study, with the Public Health Service making the contribution for the radioactivity study.

MR. STEIN: Perhaps I was not too clear. I did not mean to imply that there would be two studies. I think there will be one, which will be a complete study. As a matter of fact, under the law that we have, I think we are obliged in an interstate pollution situation to consider all aspects of the pollution, not just radiological aspects. Even if we wanted to, which we don't, we could not limit ourselves that way. We will assume for the Public Health Service the responsibility for a complete study, with the participation, as much as possible, and cooperation of, the States concerned.

What we are talking about at first was just a report on these three factors dealing with other types of wastes, so that at the next session of the conference we can come up with pretty definite recommendations.

As relates to the other sources of pollution, I do not think we have enough information at the present time to come up with, say, a recommendation for the time schedule if one is indicated, for treatment at Durango; and that is what we would like to come up with.

I do not know that the solution of these problems is necessarily as complicated as the one we are facing in radiological health, and therefore we may be able to come up with pretty definite recommendations as to the other aspects of pollution prior to the year from now, and that was the sole purpose.

Do you have anything further to add to the summary?

MR. CALDWELL: No, I believe that covers it.

MR. STEIN: Does anyone else here want to say anything in relation to this problem, or any aspect of the conference? If not, I declare the meeting adjourned at the moment.

I want to thank you all for coming and for participating. Hopefully, I think we are well on the way to an equitable solution.

The conference is adjourned.

* * * * * * * * * * * (2:45 P.M.)

APPENDIX A

ATTENDANCE ROSTER

Conference on Interstate Pollution
of the Animas River, Colorado-New Mexico
April 29, 1958

P. D. Akin	State Engineer's Office, Santa Fe
Aleck Alexander	U. S. Public Health Service, Denver
J. B. Anderson	U. S. Public Health Service, Dallas
Robert F. Barker	U.S. Atomic Energy Commission, Div. of Licensing & Regulation, Wash. D.C.
John B. Barnard, Jr.	Assistant Attorney General, Denver
Lester E. Blaschke	U.S. Public Health Service, Indian Health Division, Albuquerque
Robert L. Brashears	N.M. Dept. of Game and Fish, Santa Fe
Fred A. Brinker	Vanadium Corporation of America, Durango
W. L. Bruce	Animas River Water Users Assn., Durango
Charles G. Caldwell	N.M. Dept. of Public Health, Santa Fe
C. W. Christenson	Los Alamos Scientific Laboratory Los Alamos
Roy L. Cleere, M. D.	Colorado Dept. of Public Health, Denver
J. H. Fooks	U. S. Public Health Service, Denver
William N. Gahr	Colorado Dept. of Public Health, Denver
Edmund Garth	U.S. Public Health Service, Denver
D. R. George	Nat. Lead Company, Winchester, Mass.
Warren Griffin	San Juan County Health Dept., Aztec
T. J. Haycock	Albuquerque Operations Office Atomic Energy Commission
John W. Hernandez	N.M. Dept. of Public Health, Santa Fe
Carl R. Jensen	N.M. Dept. of Public Health, Santa Fe
Daniel E. Johnson, Ph.D.	State Public Health Laboratory Albuquerque
W. R. Kennedy	Los Alamos Scientific Laboratory Los Alamos

Keith S. Krause	U. S. Public Health Service, Dallas
Stanley J. Leland, M. D.	N.M. Dept. of Public Health, Santa Fe
Robert P. Lowe	N.M. Dept. of Public Health, Santa Fe
A. B. Luke	Animas River Water Users Assn., Durango
John J. Lyon	Animas River Water Users Assn., Durango
George W. Marx	Ariz. Dept. of Public Health, Phoenix
Paul W. Masters	N.M. Dept. of Public Health, Santa Fe
John A. Maxwell	Vanadium Corporation of America Durango.
F. E. McGinley	U. S. Atomic Energy Commission Grand Junction Operations Office
Richard L. Moore	Colo. Dept. of Game and Fish, Denver
Robert P. Morfitt	U.S. Public Health Service, Indian Health Division, Window Rock, Arizona
Warren A. Rasmussen, M. D.	San Juan County Health Dept., Aztec
Gruine Robinson	N.M. Dept. Public Health, Santa Fe
W. B. Schreeder	U.S. Public Health Service, San Francisco
Zane Spiegel	State Engineer's Office, Santa Fe
Murray Stein	U. S. Public Health Service Washington, D. C.
Calvin K. Sudwicks	Utah Dept. Public Health, Salt Lake City
J. D. Torrey	Colo. Dept. of Public Health, Denver
Dr. E. C. Tsivoglou	Robert A. Taft Sanitary Engineering Center, Cincinnati
Dr. D. E. Walker	U. S. Atomic Energy Commission, Idaho Operations Office, Idaho Falls
Dr. Francis J. Weber	U. S. Public Health Service, Denver
A. J. Whitman	U. S. Atomic Energy Commission Albuquerque Operations Office